THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXVIII. No. 2013.] LONDON, DECEMBER 10, 1901. [53RD YEAR. PRICE 6d.

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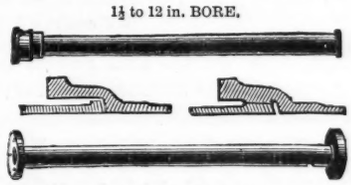

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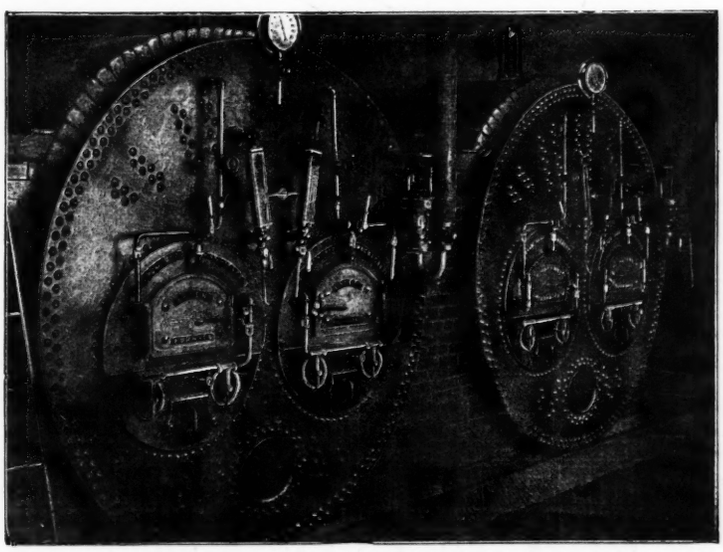

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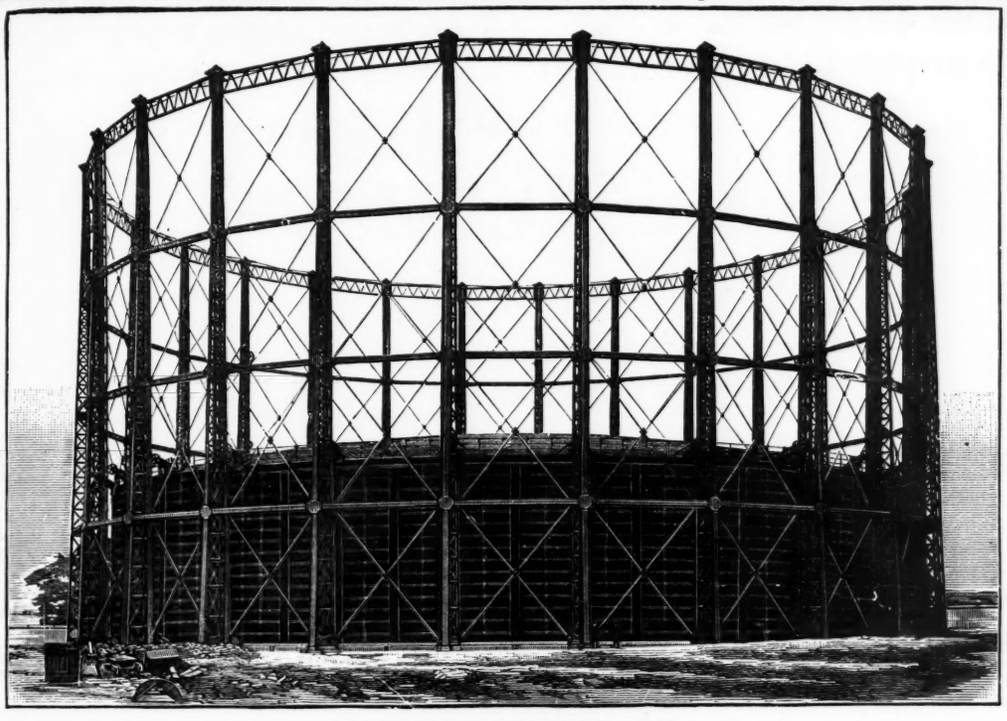

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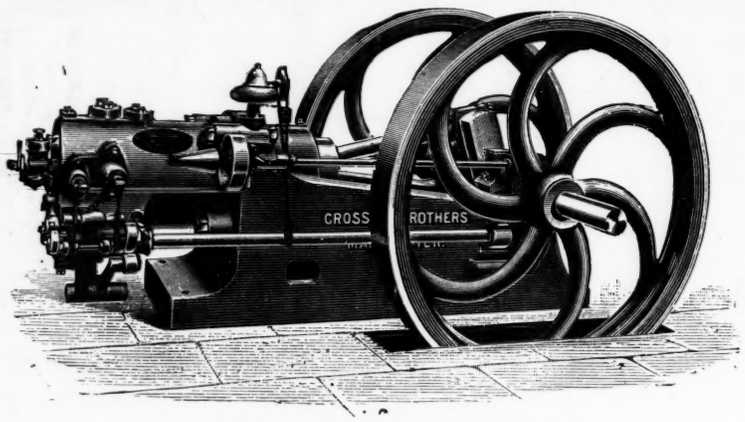

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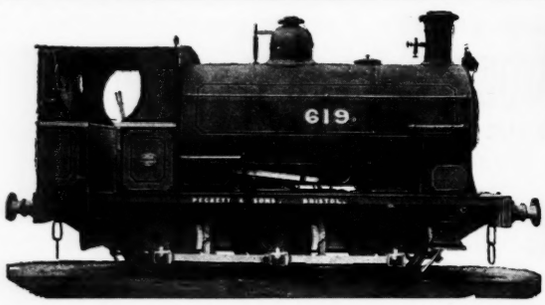

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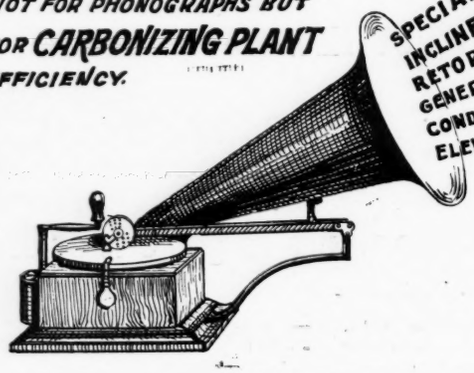

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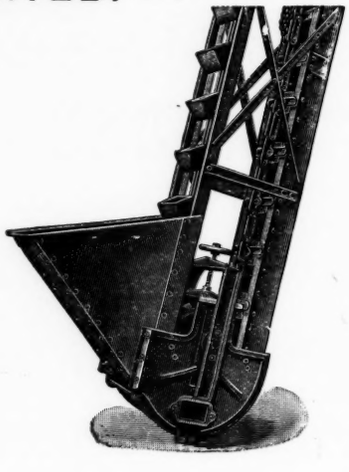

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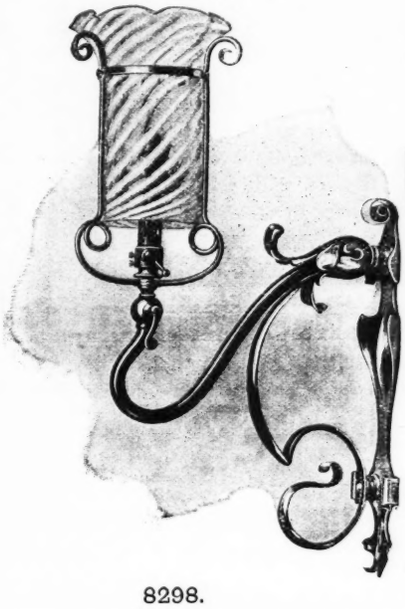

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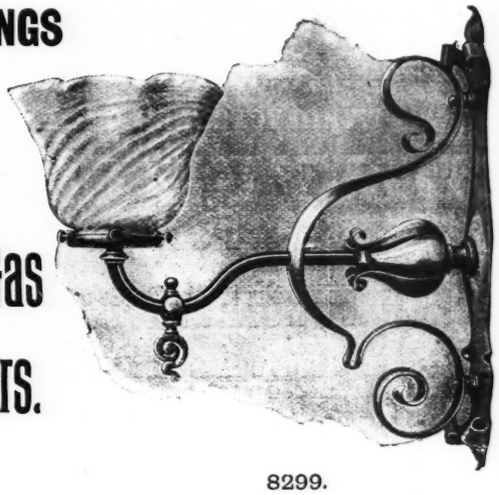

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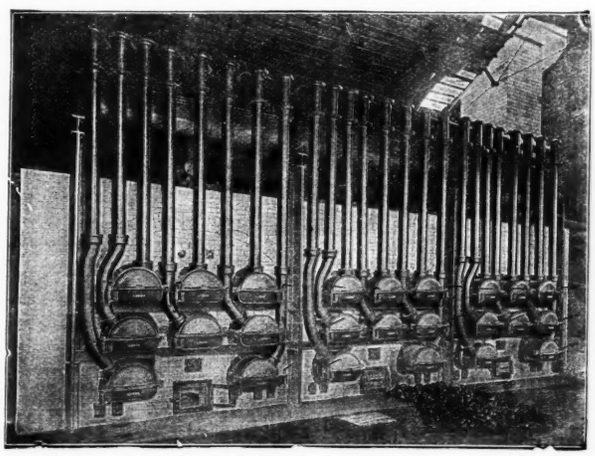

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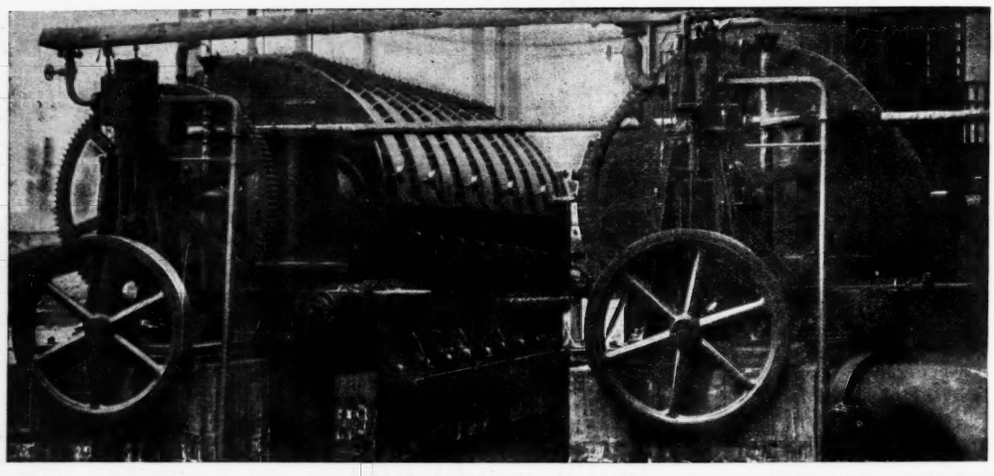

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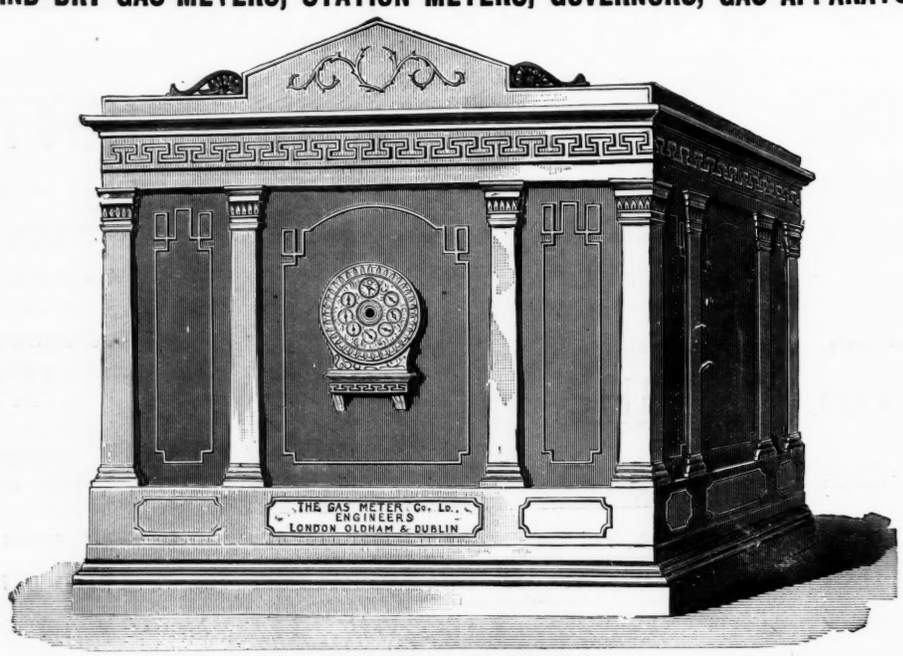

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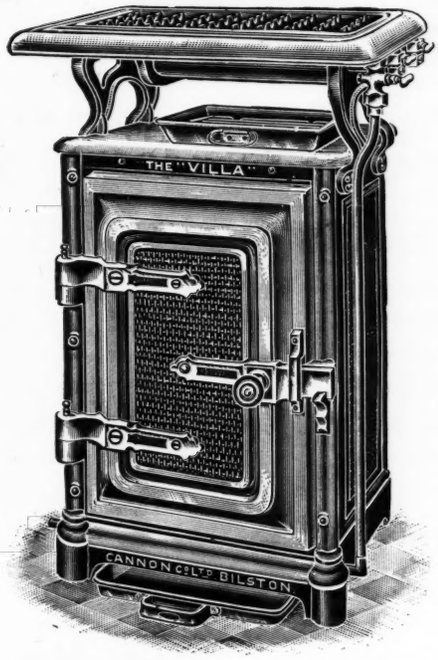

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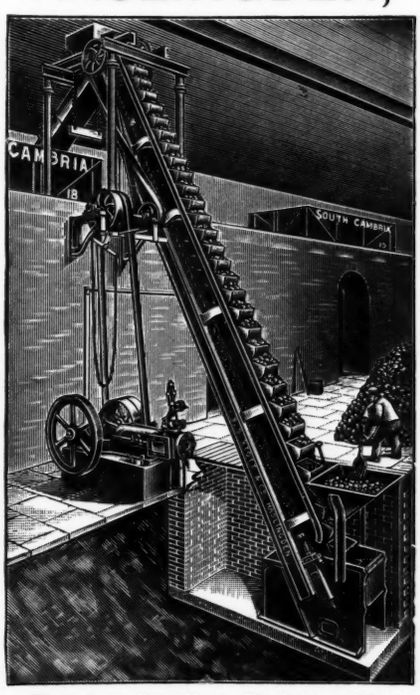

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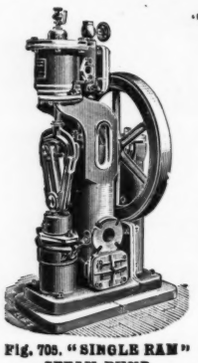

Fig. 705. "SINGLE RAM" STEAM-PUMP.

Fig. 898. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

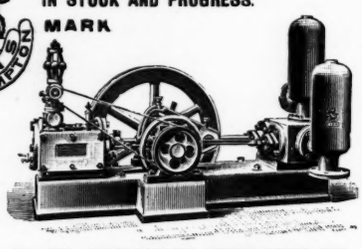

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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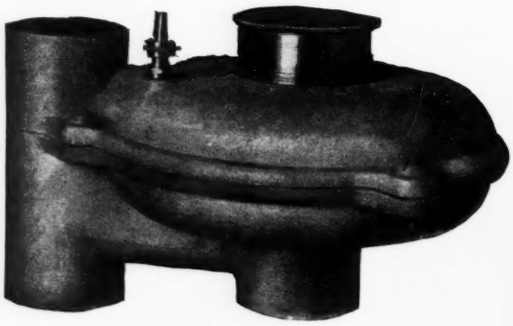
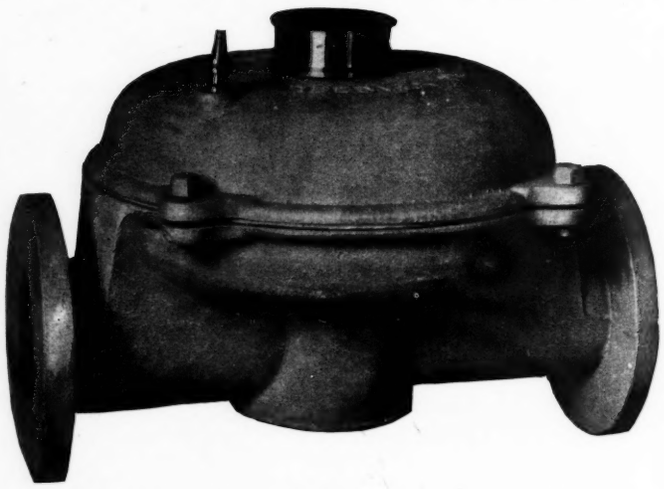


For any situation where it is desired to control the pressure to a number of Lights.



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CONTENTS.

EDITORIAL NOTES.

GAS, LIGHTING, &c.—
Municipal Trading on its Trial 1509
The South Metropolitan Gas Company and the Gas Referees 1509
The Position in the Coal Trade 1510
Incandescent Gas Lighting and "The Trade" 1510
In the Cause of Parliamentary Efficiency. 1511
WATER AFFAIRS—
Statistics of the London Water Companies 1511
British Association of Water Engineers—The Judgment of the Local Government Board 1512
The Last of the Conference Papers . . 1512

ESSAYS AND REVIEWS.

The Position of Liquid Fuel 1513
Fair Play for the De Brouwer Conveyor . . 1513
Electric Lighting Memoranda 1515
Gas and Water Stock Market 1515
The Season's Electric Light Appliances. . 1515
The Vienna Municipal Gas-Works . . . 1517

NOTES.

The Efficiency of Wilson Gas Producers . 1522
The Preservative Painting of Ironwork . . 1522

COMMUNICATED ARTICLE.

The Auditing of Gas Companies' Accounts. By F. G. Newton 1523

TECHNICAL RECORD.

Heckmondwike Inclined Retorts and Coal and Coke Plant 1524
American Gaslight Association 1526
Tests of the Clamond Gas Radiator . . . 1527
Temperature Correction Table for Oils . . 1529
British Association of Water-Works Engineers—Winter Meeting 1529
Storing, Analyzing, and Treating Water. . 1529

REGISTER OF PATENTS.

Gas Water-Heater and Calorimeter—Simmance, J. F., and Abady, J. . . . 1534
Prepayment Gas-Meters—Cowan, W. . . 1534
Locking Devices for Gas-Taps—Newbigging, E. L. 1535
Manufacture of Illuminating Gas and Coke—Ruppert, O. 1535
Patent Notices 1536

CORRESPONDENCE.

Manchester District Gas Engineers and the Wakefield Inclined Retorts 1537
Inclined *v.* Horizontal Retorts with Machinery in Large Works 1537
Retort Ascension-Pipes 1538
Main-Tap Fasteners 1538

LEGAL INTELLIGENCE.

Marylebone County Court—Liability for Damage Caused by a Burst Water-Main . 1538
Coal Contract Dispute 1538
Acetylene Explosion at Dawlish 1539

MISCELLANEOUS NEWS.

Answers to Questions on Gas Manufacture . 1539
London County Council and Gas Testing . 1539
Glasgow Corporation Gas Bill 1540
Colwyn Bay Gas Arbitration 1540
Birmingham Corporation Bills. 1543
New Gadd and Mason Gasholder at Retford 1543
Leeds Corporation Gas Supply 1543
Provincial Rates and Gas, Electricity, and Water Charges 1544
Welsbach Lighting in Australasia. . . . 1544
Walker Electric Lighting Scheme. . . . 1544
Public Lighting Dispute at Kingston . . . 1544
Kitson Lamps for Public Lighting . . . 1545
Sales of Stocks and Shares. 1545

MISCELLANEOUS NEWS (*continued*)—

Gas *v.* Electric Lighting in Fog 1545
Electric Lighting Notes 1545
Increased Water Storage for Heywood . . 1547
Teignmouth Water Supply. 1547
Notes from Scotland 1548
Current Sales of Gas Products 1549
Coal Trade Reports 1550

PARAGRAPHS.

Forced Draught 1516
The Gaslight and Coke Company Push Business 1521
Obituary and Personal 1522
Omagh Gas-Works Purchase—Income-Tax on Gas Profits at Manchester 1536
Sale of the Airedale Gas-Works to Bradford—Newhaven and Seaford Water Company 1538
Birkenhead Water Supply—Cost of Public Lighting at York 1539
Illuminating Power of Gas at Birkdale—Trade Unions and the Law as to Picketing . . 1543
New Gas-Works at Konigsburg 1546
Dispute as to Removal of Lamp-Posts at Rathmines 1547
Consett District Water Supply—Swindon Water Supply—German Incandescent Gas Share Company—Haverhill Water Supply—End of the Milan Strike—Brynmawr Water Supply—Loughborough Gas Supply 1551
Hayle Gas Company—Gas-Workers' Wages at Workington—Southwark and Vauxhall Water Company—Water Supply by Meter for Trade Purposes—Burgess Hill Water Company—Grand Junction Water Company—Complaints of Impure Gas at Holyhead 1552
Gas-Meter Indices to be Tested in Manchester—Southport Corporation Gas Supply—Profits and Price of Gas at Bolton . . . 1553

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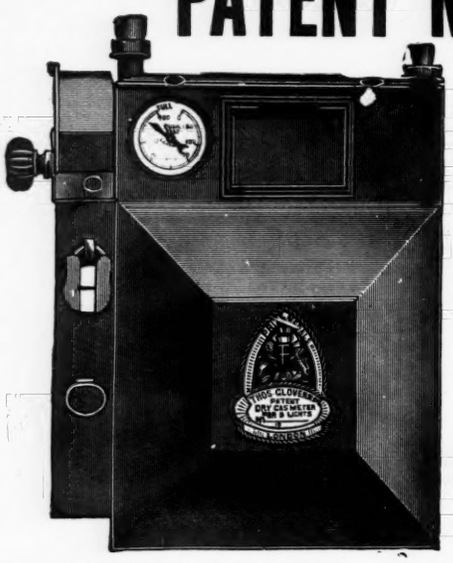

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VOL. LXXVIII., No. 2013.—TUESDAY, DECEMBER 10, 1901.

EDITORIAL NOTES.

Municipal Trading on its Trial.

THE cooling breezes of common sense, sound law, and cold experience are beginning to blow upon the fevered brow of the ardent partisan of municipal trading "on principle;" and some sufferers from this sickness of the Age will doubtless recover all in good time. The inevitable failure of the smaller and less favourably circumstanced municipal electric lighting ventures, which is beginning to show its disagreeable premonitory signs unmistakably in various parts of the country, will prove a great discouragement to those local politicians who have supported the principle without any interested or ulterior motive. We have been roundly abused in different quarters, of course, for daring to assert that the day of reckoning for a good many of the weaker local authorities' electric lighting ventures is now near; but really there is nothing new in our attitude in their regard. We never believed that more than a very small selection of these undertakings would pay, and unceasingly proclaimed the conviction for the benefit of whomsoever it might concern. The realization of our dismal vaticinations has necessarily been a matter of time; and the time is already running out in some instances. The consequential question of how many of these moribund undertakings will actually be allowed to die, and how many will be kept alive out of the rates for a further time, is only one of how many of the authorities interested will elect to go on throwing good money after bad, or else to "cut the loss." Really, it is not the "JOURNAL," but other papers that might be named, that has pointed out the insolvency of many such undertakings, including all those of the Metropolitan Local Authorities, which nevertheless will probably be kept going for various reasons to an indefinite period.

From about the third to the fifth year of a municipal electric lighting speculation is its critical period. If it is ever going to make both ends meet, it will do it then. Naturally; for the first year or two gathers in all the best customers, and saturates the most profitable district. The plant at the station, and the cables, are at their best also; and the rapid extension of the business near home seems of the best augury for the future. Soon afterwards, however, the wild-goose chase after additional business begins. Mains are thrust out here and there to feel for more revenue. But the station engineer sees no improvement of his load-factor; and he, at any rate, begins to "see the red light" ahead. Then the additional tale of lamps tells on dark days upon the labouring plant; and ominous breakdowns of the mains appear. Such is, literally, the experience of the Corporation of Bath, who, as may be read elsewhere, at the urgent request of the citizens, have just sent the old Corporation Electricity Committee packing with contumely, and have resolved themselves into a Committee of the Whole House, with the object of ascertaining what had better be done in the physical and financial emergency that has overtaken their electric lighting undertaking.

What has happened at Bath will happen in other places. The hardly-used citizens who have forced the Corporation to take the strongest action open to them in the circumstances, are not angry with the old Committee. The case is too serious for idle recriminations. Indeed, the protesting ratepayers seem willing to lay the greatest amount of blame upon the "system"—the system of municipal trading in a commodity that demands, of those who would deal in it successfully, more skill, and knowledge, and devotion to the work than can fairly be demanded of an average town councillor. This is, undoubtedly, the *crux* of the whole matter. The members of local authorities are, or should be, chosen from their fellow-townsmen for distinct reasons, and for a definite purpose, which, until of late years, did not include the conduct of a trading concern. A man who is willing to serve his town in the capacity of a member of the corporation may be admirably suited for this distinction, without being, or pretending to be, a business man. Even if he is a man of commercial experience, it does not follow that he wants to wear the apron always—when in the council chamber as well as when out of it. In a city like Bath, for example, it is distinctively to be deprecated that the tone of the public authority should be exclusively, or mainly, commercial. Then, what is likely to follow if such a Corporation go into trade?

Even where a locality is exclusively industrial or mercantile, it does not follow that the local authority can trade with advantage. A leading case in point is that of Walker-upon-Tyne, already discussed in these columns in connection with the state of loggerheads existing between the Urban District Council and the manufacturers of the neighbourhood, who believe they know what is best for their own business needs. When the district was constituted a local governing unit, it was never intended that the Council should go into trade to the detriment of their sole supporters and paymasters—the manufacturers. But that is just what the Council have done; and, to this intent, they sought to employ, for the purposes of their trade, statutory facilities entrusted to them as administrators of the law of public health. Mr. Justice Farwell spoke a bit of his mind on this subject; and although it was not much, it was sufficient to indicate how matters would go with him if the precise question were raised in his Court.

It is no wonder that the leading case of the Walker District Council is much talked about in Newcastle. It strikes the people of Tyneside as monstrous that a local authority—a creature of a statute and their own local patriotism—should misuse its legal position to their disadvantage. The discovery that such things can be, appears to have led many worthy Tynesiders to again consider the theoretical presumption in favour of the multiplication of local representative governments. The abuse of administrative privileges so as to favour a municipal trading experiment, or to disparage a distasteful company control, is by no means new. What of the overhanging street-frontagers' lights, which are not sanctioned in the case of a gas company, but permitted as regards municipal electricity? How is it that penalty photometry is held to be of such capital importance when the victim is a gas company, while after a gas undertaking has become the property of the local authority the testing-station somehow falls into disrepair? Many similar queries might be put; but it is not worth while to labour points of detail. The general proposition is on trial; and although the judgment of the court of experience may be delayed, it will be final.

The South Metropolitan Gas Company and the Gas Referees.

THE smouldering disagreement between the South Metropolitan Gas Company and the London Gas Referees in respect of the fitting of testing-stations has broken out at last, in a report of the Public Control Committee of the London County Council contained in the Order Paper of the Council for the 3rd inst. It is there stated that two of the testing-stations for the South Metropolitan Company's gas, which were closed in the first instance for new apparatus to be provided, remain closed on account of a dispute concerning "the cleaning out of the service-pipes." It is reported that, as the Company refuse to comply with the Notification of the Referees on this head, the Referees decline to certify the apparatus; and consequently the stations cannot be used. When submitting this matter to the County Council, the mover of the resolution deplored the injury to the public accruing from so large a portion of the Company's district being "unprotected" by testing-stations. The Council have complained to the Board of Trade. As the law now stands, the only way of bringing compulsion on a London Gas Company to comply with a direction of the Referees is for the Board of Trade to certify the matter to the Attorney-General, who can take steps under the Metropolis Gas Act, 1860. The Council's Solicitor has tried to move the Board of Trade in this direction; but the Department has not yet stirred. Now a formal resolution of the Council has been passed to urge the Board to act.

From the reluctance of the Board of Trade to meddle in this business, it may be gathered that doubts exist in some quarter either as to the merits of the Referees' Notification, or as to the expediency of magnifying the Gas Examiners

office in relation to a gas supply which is notoriously in a transitional stage. Of course, no consideration of that kind could be expected to weigh with either the County Council or the Referees. There is no such "red tape" as theirs. The Board of Trade appear to be quite sportsmanlike in comparison. Meanwhile, the situation created is not a little ludicrous. What it is that has made the service-pipe the bone of contention between the most progressive of Gas Companies and the most reactionary of public functionaries, does not transpire; but it will probably prove to be some fresh phantasy of the Referees, against which the South Metropolitan Directors have put their foot down, with the intention of not budging if they can help it.

We say this because the other testing-stations served by the Company are working normally. Something novel must therefore have been the cause of the friction that has prevented the restarting of the new stations. The nature of it will appear in due course. Additional piquancy has been imparted to the old dispute by the action of the Company in promoting a Bill to disestablish the Referees, and place the testing of London gas upon an equal footing with that of other parts of the kingdom. The dispute may in part account for this feature of the Bill; but, also, the Bill may clear up the dispute. It can be safely declared, meanwhile, that the South Metropolitan Gas Company do not object to testing, in itself, and when reasonably done. To take this line would be both foolish and vain; and folly and vanity are not abnormally conspicuous in the proceedings of this Company. What the Directors do object to, however, is pedantry, functionaryism, and presumption of misconduct and double-dealing against themselves; and to none of these fungus growths of over-government will they willingly submit the great interests confided to their charge.

The Position in the Coal Trade.

THE trade papers report that there are "numerous inquiries "for large quantities of coal for next year; that sellers are "not prepared to take less than the prices which have been "realized for the current year; while some sellers think "that higher prices ought to be realized for next year than "have been secured for 1900." The figure "1900" is evidently a misprint for 1901—not even a coal trade paper would think of a return to 1900 prices. But, so corrected, the suggestion put forward, that next year's contracts are to be made at prices not less or even more than those now current, is one that must not pass unnoticed. It cannot be said too early or too emphatically that there is no reason whatever why coal buyers should not ask for, and obtain, a reduction in contract rates for 1902 and 1902-3, compared with those paid for 1901 and 1901-2. The rates now being paid are a long way from bottom. All the signs point to the probability that prices are to reach bottom before they get up again; and buyers will be foolish if they do anything to prevent that probability becoming a certainty.

At the moment, the gas coal market is firm, with an upward rather than a downward trend. But that is only a passing, not a permanent, condition. This is the time of the year when the demand for gas coal is at its maximum. The unusual amount of fog recently has increased the consumption of gas very materially, and has made gas-works managers bethink themselves of the possibility of a continuance of such weather and of what that would mean in the way of demand on their coal stores; exporters are doing all they can to get the shipments under their contracts completed before the year and the duty exemption end; the stoppages in Wales and the apprehended trouble with the miners in France have caused a special flow of orders to the North of England and Scotland—all the peculiar circumstances of the moment are, in fact, making for the stiffening of the market. These are, however, only temporary influences, the passing of which will, undoubtedly, bring about a certain reaction; and buyers cannot be too cautious in regard to entering into long-period contracts at the present moment. The railway companies, who are just now in the market for part at any rate of next year's requirements, are, it is understood, being offered coal at the same prices as those payable under the expiring contracts. It remains to be seen whether they will consider that an acceptable basis. Certainly they ought not to buy twelve months' requirements on such terms. The end of March or June would be seasons more favourable, perhaps, for negotiating yearly contracts than the month of December.

The Board of Trade returns for the month just ended afford evidence in support of the opinion that business is moving downwards, and that prices must follow in the same direction. So far as the exports of coal are concerned, the returns show a more decided decline than has been seen for many months, in spite of the fact that deliveries are being kept in a forward condition in order to escape duty. The quantity of coal shipped for sale last month was only 3,469,365 tons, as compared with 4,059,523 tons in November, 1900, and 3,511,483 tons in the same period of 1899. Including coal shipped for the use of the steamers engaged in foreign trade, the figures for the month read: 1901, 4,632,089 tons; 1900, 5,008,440 tons (decrease this year, 376,351 tons); and 1899, 4,613,150 tons. Stated in millions of tons, the total exports for the first eleven months of this year have been 52·78, compared with 53·21 in 1900, and 50·81 in 1899. The shipments in 1902 are likely to show a considerable reduction from this year's figure.

The depression in trade in Russia and Germany is reflected in these returns; our exports of coal to the former being only 50 per cent. of what they were last year. To Germany, Denmark, and Holland we sent in November, 1900, 893,649 tons; this year, only 732,772 tons. In Germany, we are losing ground to the home producers and to America (in some small measure). The imports of coal into Hamburg last month showed: British coal, decrease 24,531 tons; Westphalian, increase 27,256 tons; American, increase 7227 tons. More than half the decrease in our shipments was accounted for by a reduction in exports from Wales from 23,812 to 9448 tons; but Mr. Brace tells the Welsh miners that foreign competition is "all bogey." It is worth noticing that the Westphalian Syndicate have reduced their prices for next year considerably; steam coal will be 1s. to 2s. per ton cheaper on contracts from April 1, and coke 3s. 6d. per ton cheaper as from Jan 1.

The exports of iron and steel for the month of November were 244,131 tons, against 262,434 tons last year, and 345,638 tons in 1899. For the year, the falling-off now amounts to 652,794 tons below 1900, and 716,116 tons below 1899 exports. Railroad material is the one striking exception to an otherwise dismal record of declining trade; while in pig iron is the most noteworthy reduction—namely, from 1,375,108 tons to Nov. 30, 1900, to 789,255 tons in the first eleven months of the present year. This item alone means a reduced consumption of coal equal to about 1½ million tons. All the signs are favourable to a further reduction in the price of coal—labour difficulties always, of course, excepted. And they could only temporarily disturb the inevitable course of events.

Incandescent Gas Lighting and "The Trade."

GROWLS have arisen from time to time in the pages of the "Ironmonger" concerning the alleged encroachments of gas companies upon the legitimate preserves of "the trade," in the matter of gas-fitting. We have on former occasions commented upon the curious notions apparently entertained by the modern ironmonger as to what is orthodox for him, and heterodox in other shopkeepers. It seems to come to this: That the complete ironmonger may justifiably sell wall-papers and let eligible residential properties; but the local plumber must not sell a pennyworth of screws, nor the gas company hire out a gas-fire at the cost of the article. This is, of course, sheer arrogance. It is to be noted that the organ of the trade itself wisely gives up the struggle as against gas companies, and advises its subscribers to indemnify themselves against the too-enterprising gas company by cultivating some other line of business. The advice is good. There are many things which are open to an ironmonger, and cannot be touched by a gas company. On the other hand, gas companies have suffered so much in the past from ironmongers and "three-branch "hands," that they are not likely to relinquish any remedy which, in the slow evolution of their business methods, they may find useful. The ironmongers complain of having lost the trade in gas cooking-stoves and gas fires, through the rivalry of the gas companies; but it has often been pointed out that they never had it to lose. Now they are losing the incandescent gas-burner trade, and are grumbling about it. The only reason is that they have not been sufficiently enterprising to adopt the policy of maintaining incandescent burners and mantles while there was time. They were content to sell these articles out of hand, for such profit as they might be able to make—not without a little smuggling, in the case of the less respectable shopkeepers. This answered well enough while the incandescent gas-light was a luxury, or a fancy article. People bought the lights, tried them, and

often grew tired of them because of the bother of renewing the mantles "and all that sort of thing." Now that the incandescent gas-light is becoming the leading article in gas-burners, this catchpenny style of trafficking in it has become inadequate. Consequently, gas companies maintain the burners for a trifling charge; and the ironmonger sees another "line" closing to him. It is his own fault. If British ironmongers had undertaken incandescent burner upkeep, at considerably more than cost, the gas companies would have been long in interfering with them. They let their opportunity pass; and now it is gone for ever. Henceforward, the interest of the "trade" in incandescent gas-lights must be a fast-diminishing quantity. They ought to have acted on the principle that every incandescent burner sold is an income-earner. They should have politely inquired as to its destination, and offered to watch over its health and be answerable for its good behaviour. They did not do anything of the kind; and so they must put up with the consequences of their neglectfulness. It used to be a byword that buyers of incandescent gas-burners frequently gave up using them; but the ironmongers failed to see the real meaning of this sign.

In the Cause of Parliamentary Efficiency.

THE reform of parliamentary procedure is a cause which should interest every British citizen. We do not refer to the question of Private Bill Procedure, which was touched upon in these columns last week, but to the ordinary conduct of public business in the House of Commons. It is by no means a pleasing reflection that the habits of our elected legislators have not improved, as regards what is humorously called "the dispatch of business," agreeably with the multiplication of newspapers, the spread of School Board education, and other aids to progress. In some respects the manners and customs of members of the House of Commons have softened since the classic times when the borough of Eatanswill returned its member in the fashion described by Dickens, and the House comported itself in debate as depicted in the contemporary tale of "Sylvester "Sound." But a good deal of what has been gained by the nation at one end has been lost at the other. Some of the existing defects of the modern House of Commons were very temperately set forth by Mr. F. W. Lowe, M.P. for the Edgbaston division of Birmingham, in a recent popular address; and it is greatly to be hoped that other members and their more influential constituents will give equal thought to these matters, so that Parliament may be rehabilitated in the estimation of business men. Otherwise, session after session must be barren; and the country will be condemned to wait indefinitely for such boons as the codification of the law of Public Health, and other measures out of which there is little party capital to be made.

The desirable reform is not so much a question of rules and ordinances as of a new spirit actuating the loyal and reasonable majority of the House of Commons. The grand heritage of freedom enjoyed by the House is not to be lightly relinquished for the sake of getting the votes taken a little quicker. It is to be hoped that the rigid formality of the artificial legislative assemblies of foreign countries will never be forced upon the House of Commons, which has always been much more than a mere machine for making laws. If all the members of the House who are well disposed towards the realm, and honestly desirous of serving their constituents, would but think more of these obligations, and less of their own fads and self-advertisement, Parliament would be a different institution. As it is, the vanity of some members and the prejudices of others play into the hands of the downright disaffected minority.

Take the private members' nights, for example, when the House is supposed to be at the disposal of unofficial legislators, untrammelled by party considerations in their endeavours to benefit the country in some way. This is the idea. The fact is that all the time allotted for this ostensible purpose is predestined to be wasted, session after session, by "hardy annuals," which are mostly either obstructions or potential nuisances. Questions, also, are open to the objection of being merely obstructive tactics. The ridiculous modern practice of dividing the House over and over again for no reason at all, is another grave scandal; and so is the measureless loquacity of some of the talkers whose names turn up in the papers every morning. It is quite certain that the constituencies could lend material assistance in abating these evils, and so consequentially restoring to Parliament some of its wasted time.

WATER AFFAIRS.

Statistics of the London Water Companies.

IN view of the notices which have been given by the Government and the London County Council for Bills to authorize the acquisition of the London Water Companies' undertakings, the financial position of the Companies and the extent of the service they render to the public are subjects which, it may naturally be supposed, will be very much discussed, both in Parliament and at meetings of municipal bodies, during the next few months. Consequently, any information which will lead to a just appreciation of these subjects cannot but be valuable to all who are really interested in the important question of the future control of the water supply of the Metropolis. This information will, we venture to think, be found in the "Analysis" of the Companies' accounts prepared annually by Messrs. Lass, Wood, and Drew, the twenty-first issue of which was briefly noticed in the "JOURNAL" last week; and therefore it will not be out of place to indicate here some of the leading features of that useful compilation, which occupies the position in regard to water supply which "Field" does to the gas industry. The "Analysis" just published deals with the financial year ending Dec. 31, 1900, and March 31, 1901, and it shows that at the close of this period the total amount of share and loan capital authorized in respect of the supply of water in London was £23,418,402, of which £19,371,632 was employed—being at the rate of £250·35 per million gallons, compared with £239·12 per million before. The Companies have expended £19,126,273 on works, which in the year ending Dec. 31 last sent out for general purposes 77,397,748,495 gallons of water; the average daily supply being 212,048,626 gallons, of which 163,433,731 gallons were for domestic, and 48,614,895 gallons for all other uses. The corresponding figures for 1899 were 162,118,514 and 48,133,170 gallons respectively. The average number of houses supplied during the year was 905,932, against 884,169; the population served being estimated at 6,096,665, against 5,953,529. The average daily supply for purely domestic purposes was 180 gallons per house, and 26·81 gallons per head of the population—being a slight reduction on the previous year's figures, which were 183 and 27·24 gallons respectively. For all purposes, however, the quantity supplied was 234 gallons per house, and 34·78 gallons per head of the population.

The number of houses which had a constant service on the 31st of December last was 859,841, compared with 825,077 on the corresponding day in 1899. In the course of the twelve months, therefore, 34,764 additional houses in the area served by the Companies were furnished with an uninterrupted supply of water. Of these, 9062 were put on by the West Middlesex, 7685 by the New River, 6391 by the East London, 4564 by the Kent, 3647 by the Lambeth, 1878 by the Grand Junction, 950 by the Southwark and Vauxhall, and 587 by the Chelsea Company. We give these details in order that they may be contrasted with the following figures, showing the increase in the number of houses supplied by the Companies last year: West Middlesex, 1383; New River, 3056; East London, 6157; Kent, 3638; Lambeth, 3525; Grand Junction, 1878; Southwark and Vauxhall, 1247; and Chelsea, 587. It is interesting to note—and the fact may be commended to the consideration of the detractors of the Companies—that all the Chelsea and Grand Junction Companies' new services were constant; while the much-abused East London Company put on 234, and the West Middlesex Company 7679, more constant supplies than they had new ones. It will be seen from the foregoing figures that every Londoner has at his command nearly 27 gallons of water practically constantly available for his domestic requirements; and yet a set of stump-orators go about seeking "popular applause," as Mr. Long called it, by denouncing the Directors of the Companies for their utter disregard of the requirements of the consumers!

The total income of the Metropolitan Water Companies for the period covered by the "Analysis" was £2,394,767, against £2,363,246 in the year 1899-1900, or at the rate of £30·95 per million gallons of water and £2·64 per house supplied. Maintenance and management cost £1,056,081, or £13·65 per million gallons and £1·16 per house; and the net profit was £1,032,243, or at the rate of 10·03 per cent. on the stock and share capital, compared with 10·27 per cent. for the preceding year, and 10·06 per cent. in 1898-9. In the case of four Companies the net profits were in excess of the amounts required for the statutory dividends; in the

other cases there were deficiencies. On the whole, the supply of water to London is not an unprofitable business; and consequently the owners are by no means desirous of parting with it. They stand, as Mr. B. L. Cohen pointed out to the London County Council a few days ago, as "eight unwilling sellers" before "two willing buyers;" and whoever has to appraise the value of their property for the purpose of its transfer to a public body will have to take this circumstance into account.

British Association of Water Engineers—The Judgment of the Local Government Board.

THE remnant of the programme arranged for the last annual meeting of the British Association of Water-Works Engineers (the proceedings at which, it will be remembered, were interrupted by the fire at the Birkenhead Town Hall) supplied, with but little addition, abundant material for the winter meeting last Saturday. The papers discussed were not, however, on subjects which afford scope for the editorial pen. The question, for instance, of the "Design, Construc-"tion, and Cost of Open and Covered Reservoirs," is a large one; but its very vastness, and the want of concentricity of opinion on the numerous points involved, defy useful comment in a limited space. A whole morning's sitting was spent by members talking round about the subject; and probably had the Chairman (Mr. Frederick Griffith) not given a hint that the discussion must be closed before the midday adjournment, those present could have exhausted the afternoon sitting as well with such a theme, upon the hundred-and-one points connected with which water-works engineers can pour out fancies and experiences in almost any quantity. In the discussion, however, Mr. William Matthews, of Southampton, had something to say about one of those unaccountable actions of the inspecting department of the Local Government Board which brings that body into bad odour with professional men, and gives birth to recurrent cries for reform. In the case related by Mr. Matthews, the Board refused to allow the governing body of Newport (I. of W.) to construct a circular water reservoir. Circular water reservoirs, like gasholder tanks, are not new things among us; they have been proved by time, and are now growing in favour among water engineers. This being so, it would be interesting to get to the real reason for not permitting the engineering adviser of the Newport Council, and that body too, to have a preference as to the shape their new reservoir should take. As Mr. Matthews has interested himself in the matter, we question altogether the validity of the grounds for the decision of the Board.

This little episode, however, brings to the surface again the question as to whether the machinery which the Board have at their disposal is adequate to, and proper for, the needs of the work which they have to supervise and control. The military and other engineers whom the Board appoint as Inspectors may be very good men in certain branches of engineering; and they may, and in most cases no doubt do, conscientiously perform the duties entrusted to them. But the point is: Are they fitted, by training or attainment, to arbitrate upon the multifarious engineering questions and schemes which are submitted to them, and over the life or death of which they hold an almost despotic power? Each Inspector may be qualified to pronounce on questions relating to a particular class of engineering, but certainly (unless he be an extraordinarily gifted man) not on all. He may be a good railway engineer, and yet be utterly incompetent to pronounce judgment on a water, a gas, or an electric lighting scheme. Small wonder, then, when it is left to a single individual to accept or reject matters foreign to his own particular learning, that we find the projectors (who may be men of standing in their special line) speaking scornfully of the Board and of arrogance on the part of the Inspectors. Inspectors of specialized training, and of undoubted competence, to deal with matters in their own line, are what are required to give confidence that justice will be and is done to each and every scheme brought before them. We hope the Council of the Association will look into the incident mentioned by Mr. Matthews, and bring the full facts to light, in order that, if thought fit, an effort may be made to persuade the Board of their or their advisers' error in restricting—if that is the intention—the style of reservoir architecture. There are certain situations and other considerations which will give to circular reservoirs a preference over rectangular or other shapes; and it will be a great pity if the thin end of the wedge to what appears to be an arbitrary limitation in construction is allowed to remain in without protest.

The other subject discussed had reference to American, French, and English practice in the manufacture of cast-iron pipes; and it appears likely that the Council of the Association will, after consideration, make a recommendation on the question of standardization. The ordinary business embraced the election of the office-bearers; and Mr. Frederick Griffith, of Leicester, was honoured by a unanimous appointment to the head of the Association. As will be seen elsewhere, some important additions were also made to the list of members.

The Last of the Conference Papers.

WE complete to-day the report of the proceedings at the Sanitary Institute Conference on Water Supplies and River Pollution, by giving abstracts of the remaining papers taken on the morning of the second day, with the discussions thereon. As the principal features of the papers are brought out in what appears elsewhere, it will be enough to indicate here the salient points. The paper by Mr. H. W. Russell (his second contribution to the proceedings) is one which should be studied by those members of the London County Council who are always crying out about the "depletion" of the Thames. The author brought forward some facts and figures which showed clearly that the river is quite capable of sparing the large quantity of water required to supply the Metropolis. He told the delegates that there is an excess of water sufficient to provide some 80 or 90 days' supply for London, without interfering with what is needed for navigation and for properly scouring the channel; and he expressed the belief that enough water might at times be abstracted, "with advantage to the river," to provide the quantity which Lord Llandaff's Commission estimated would be required in 1941. Eighty days' storage of this bulk of water would mean accommodation for 22,000 million gallons in excess of that already constructed or in progress. This would be a big work. Shortly put, Mr. Russell's point was this: The Thames will yield plenty of water; take it and store it.

In his paper on "Water Standards," Mr. H. R. Kenwood gave details of a case from which he drew the conclusions that, in the first place, the chlorine standard is useless for the purpose of detecting the smaller degrees of dangerous pollution; and, secondly, that, before giving an opinion as to the safety of drinking a particular water, it is of the greatest importance that careful local investigation should be made for all possible contaminating influences. The discussion of this paper, in which the advantages of a full analysis were emphasized, brought out a very good example of the propensity of local authorities for getting things done "on the "cheap." According to a statement made by Dr. Bostock Hill, of Birmingham, they even seem to try to get their water analyses done on "the lowest possible tender," and do not seek "an opinion based on the best material at disposal." He considers this to be the cause of many of the troubles which arise in connection with these analyses. Mr. Kenwood, in reply, supported this statement, and said in certain cases the lowest tender was "2s. 6d. per sample"!

Dr. Rideal's paper on the "Purification of Water" was one of the most important contributions for the delegates. He pointed out that the present methods of purification are based on sedimentation and filtration, and he acknowledged that, when well conducted, they yield a water nearly as good hygienically as germ-free water produced by heat sterilization, Pasteur-Chamberland filtration, or chemical treatment. To obtain an ideally pure water, however, one of the latter processes might, he said, be used. He suggested that heat sterilization was well worth the attention of water engineers, spoke highly of the Pasteur filter, and expressed the opinion that ozone, which is now being tried by one of the London Water Companies, was the most likely agent to come into use in connection with the chemical treatment of water. The paper led to a most interesting discussion, which was opened by Mr. T. Caink, of Worcester, who adduced some notable facts in regard to the influence of filtration in the prevention of typhoid fever in the city. They were, however, listened to with some impatience by the delegates; nor did Dr. Rideal's views as to introducing filtration of water after its delivery to the consumers receive support.

The final paper was one by Mr. F. Verney, a member of the London County Council, who dealt with the commercial, industrial, and sanitary value of soft water. The object of the author was obvious; and his paper did not excite much interest. This brought to a close a Conference which, without producing any very striking results, amply justified the action of the Sanitary Institute in convening it.

ESSAYS AND REVIEWS.

THE POSITION OF LIQUID FUEL.

THE use of oil fuel for steam raising and other important applications has recently received an accession of "advertisement" in the daily newspapers and in some engineering journals, which can be easily traced to the enterprising agents of the proprietors of the Borneo and Texas oilfields. During the last few weeks, a "Press View" of the steamship "Clam," of the "Shell Line," was arranged; the attraction being a steamer that had run for two years, and done 85,000 miles, on liquid fuel. The natural consequence of this exhibition was the fresh outburst of advertisement already alluded to. The subject is by no means novel. This is not the proper place for setting forth all that is known concerning oil fuel for steamer use; but those who are interested in the matter can be assured that the records of the experimental use of liquid fuel for steamships are neither scanty nor imperfect. This being the case, it may arouse some surprise that there is yet room for the new "boom" in oil fuel, which the latest comers into the industry are so strenuously engaged in organizing, with the aid of the most approved modern methods of gaining the public ear. It is not difficult to understand this situation.

In the first place, it is deemed desirable that a market should be found, or created, for enormous supplies of petroleum distillates which are not good for anything but to burn, or for gas-making by the various embodiments of the Lowe process of carburetted water-gas manufacture. The demands on account of the latter are only sufficient to absorb a small fraction of the possible supply. Sir Marcus Samuel, the head of the "Shell" enterprise, talked the other day of the output being 100,000 tons per diem. It is obvious that all the gas oil needed for the United Kingdom can only be a drop in such an ocean. And such as it is, neither the permanence nor the unlimited extension of the manufacture can be assumed as certainties. What is to become of the remainder of the vast supplies of fuel oil? There can be nothing else to do besides selling it for fuel—in which, of course, it has for competitors coal, coke, and gas. Now, it is broadly true that there is at the present time no general demand for oil fuel.

The fact of the matter is that it has never paid anybody to buy liquid fuel for extensive use instead of coal, coke, or gas, except in a few special instances, which go to prove the rule. Probably, makers of common coal gas for the supply of towns have the best claim to be regarded as the earliest users of liquid fuel for industrial purposes; having from time out of mind been accustomed to burn their residual tar when there was no market for it. Hence, if there is any "progress" in the adoption of this description of fuel, these gas managers ought to have the credit for it. But nobody knows better than the gas manager precisely when it pays to burn coke in his furnaces, and sell tar, and when to reverse the proceeding. Why should there be any ascription of "progress" in regard to one of these alternatives, and the denial of it to the other? The cant of calling that "progress" which is merely change of procedure, is one of the tricks of partisans which may impose upon the multitude, but should not be heard among technicians.

There is no secret whatever about the satisfactory burning of liquid fuel, whether it is gas tar, or petroleum oil, which is almost tar in everything but the name. It is possible to burn it slowly, by trickling it into the furnace; or, if the rate of combustion must be increased, it can be burnt at almost any desired speed by means of a blast. There are as many devices for effecting the latter object as there are days in the year. The most compact and easily adjustable expedient is the steam atomizer and injector, of which there are many patterns. The most approved usually combine an arrangement for warming the oil or tar in order to increase its fluidity, with annular deliveries of oil, steam, and air. One good pattern of the appliance is about as desirable as another. The best uses up at least 10 per cent. of the steam it generates; and the worst may waste about twice the quantity. This large consumption of steam, which has to be made good by an equal evaporation of fresh water, has usually been regarded as prohibitory of the employment of the system for ocean steamers. The point was not mentioned in the newspaper accounts of the performance of the steamship "Clam."

Obviously, if 10 per cent. of the steaming power of an injector oil-burner for steam-boilers goes to run the injector, this proportion of the weight of liquid fuel must be added to the quantity required to be burnt to make the same weight of steam as solid fuel. And if the additional supply of water for this proportion—which goes up the chimney—has to be evaporated for the purpose from salt water, it means more expense and room occupied. The fact remains that oil fuel only commends itself for preferential use as compared with coal, where the latter is very costly, and cannot be raised on the spot. We are told, for instance, that on the Californian coast, or by railways and boats actually touching a source of fuel oil supply, fuel oil is successfully used. This is all that the evidence amounts to for the present. It is not stated at what figure the oil is actually put into the bunkers or the locomotive tenders. The much-talked of oil-fuel burning of Mr. Holden's Great Eastern locomotives does not count in this connection; the gas tar so used being a worthless residual on the Company's own works.

All this comes back to the original contention of this article, that it does not pay ordinarily to buy liquid fuel for burning instead of coal, coke, or gas. If it can be had for nothing, or less than nothing, because it is something that must be disposed of somehow, then it may for some purposes be conveniently burnt. This, it can be asserted with complete confidence, is the truth about liquid fuel. At what price could Borneo or Texas fuel oil be imported into the United Kingdom for sale upon its fuel value? It must be placed in the users' hands for 10s. per ton; and must never be dearer. Gas tar is not worth 15s. per ton to burn. It is always sold off, at that price. Of course, the idea of a British ship not herself touching at an oil port under the British flag, being absolutely dependent upon oil for her power of movement is preposterous. Scarcely less so is the notion that any British industry should be so dependent. The British gas industry learnt what that condition meant, even when the dependence was only a question of a small degree, when gas coal last rose in price. So striking a lesson on the economic truth that it is coal that sets the market value of fuel, not oil, is not likely to be quickly forgotten. Not until the tables are turned, and it is oil that sets the value of coal, will the former product be regarded as possessing more than a secondary standing.

The chief hindrance to an industrial triumph for petroleum fuel—perhaps even a far greater hindrance than its restricted origin and the uncertainty of the supply—is its largely varying price. Apart from such extraordinary vagaries of the coal market as that of two years ago, coal is a commodity of very steady value. Prices may vary by a shilling or two per ton; but this is not a very disturbing matter. There is so much coal, and it is to be had from so many places, that the purchaser—at any rate, in the United Kingdom—has a wide range of sources to choose from, and need never be driven into a corner. The case of oil is altogether different. On the fields themselves, the price of the crude oil may, and does, jump up and down through ratios to the mean which far exceed anything in the history of coal mining. Those who control the actual supply of the world's markets would be more than human if they did not seek their own profit in these oscillations; but that is not the way to meet the fuel requirements of the Universe.

The foregoing reflections altogether fail to grapple with the problem of what is to become of all the fresh supplies of fuel oil which the Shell Company and their allies in Texas are preparing to pour into this country. Sir Marcus Samuel said "within seven days of London was a cargo of 8000 tons, which would be the first Texas oil to reach this country. The supply will be continuous." What is to become of it? Time will doubtless show. One would imagine that the older of the American oil importers, and the Russians, cannot survey with complete equanimity the appearance in their whilom preserves of competitors who are bent, so to speak, upon forcing the back door of the trade. For the very existence of the Russian oil industry, and much of the profit of the Pennsylvanian, is bound up with the possibility of selling at a paying price the distillate which is not good for much except for gas making. It is only for this use that anybody would pay upwards of £2 per ton for it. This, be it observed, is a long way above the mere fuel value of the commodity. What, then, is to become of the Russian and older American gas-oil trade if the market is flooded with this new stuff, which is to be offered as fuel? Nobody can sell fuel oil at £2, or even £1 per ton; whereas before large fuel users will even look at it—to say nothing about altering all their arrangements for storing and handling their fuel—they must be persuaded that the stuff is to be had in unlimited quantity at such prices as they can afford to pay. We have put this figure at 10s. per ton. If it is wrong, we shall be glad to have it corrected; but meanwhile it stands.

FAIR PLAY FOR THE DE BROUWER CONVEYOR.

THE first installation of the De Brouwer coke-conveyor in this country was made at the Crystal Palace District Gas Company's works, by Messrs. W. J. Jenkins and Co., Limited, of Retford; and, by the courtesy of Mr. S. Y. Shoubridge, the "JOURNAL" was privileged to introduce the new plant to the gas engineering profession. Naturally, therefore, we have taken some interest in the progress of this new type of conveyor, and have watched for the verdict of experience as to its capabilities as an economic adjunct of the retort-house—not with the view of according it any special favour, because, as with other things so with coke-conveyors, the one that is most fit for the duty it has to perform (no matter what we might say) is the one which will be rewarded with the greatest measure of success. Since the notice of the Crystal Palace plant was published, many engineers have journeyed to Lower Sydenham to inspect it; and the conveyor has taken the fancy of several, with the result that there are to-day eight installations actually at work in England, spread over the country from Newcastle in the North to London in the South. The aggregate length of these conveyors is 4300 feet, measuring from centre to centre of the end pulleys; and before the end of next January, there will be considerably over a mile at work in England alone. Seeing that the Sydenham installation only commenced working just two years ago, this must be considered very substantial progress.

Now anyone who has seen this type of conveyor in operation will not to-day dispute the statement we made nearly two years ago as to its silence, steadiness, and smoothness in movement;

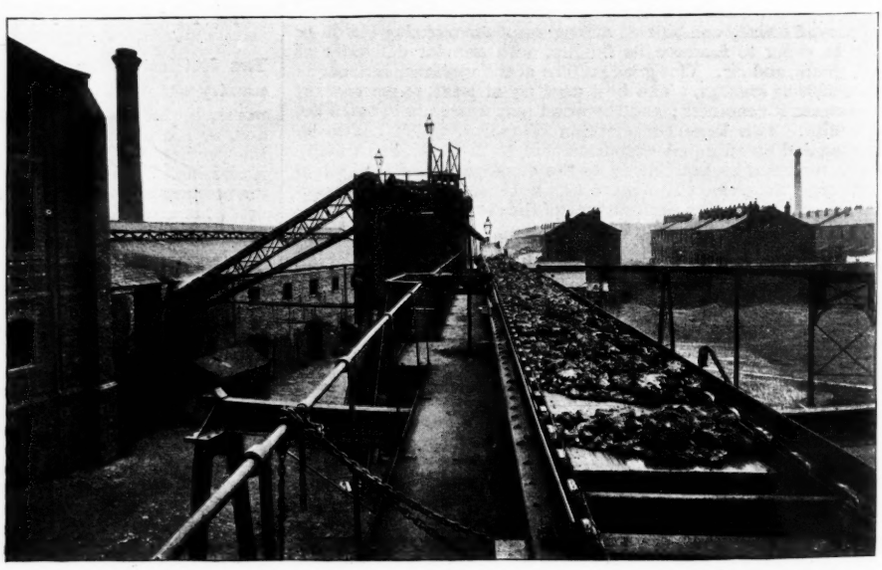
and the published testimony of engineers who have adopted the conveyor is favourable in regard to its admirable working. But there are two respects in which the De Brouwer plant has been somewhat unfavourably criticized; and these are, first, as to its supposed propensity for breeze-making, and, secondly, as to the wear and tear. Now fair play is a boasted characteristic of Englishmen; and we believe that the conveying-plant makers of this country possess as much of that virtuous quality as the rest of the race, and would be the first to applaud any effort to clear away anything which may be, through misconception, detrimental to a competitor. In the interests of fair play, then, we are writing, and not for the purpose of advertising. Besides, there is a technical question involved here. There may be a mistake as to the actual part of the plant which produces the breeze, if excess there be. It may be that a little engineering ingenuity may set it right; and a small addition to the plant here or there may have a beneficial effect. It may be, too, that some engineers have little fancies of their own, which combined with the plant may help to make the breeze nuisance greater, the discredit for all of which it is easy to dump upon the conveyor.

Before dealing with the two suggested adverse points, we will introduce a few opinions as to the general performance of the conveyor, in order to render the easier the duty of tackling the criticisms. We have taken the trouble to look up the unsolicited statements of experience of users of the plant, in regard to its operation. We first turn to the testimony of the oldest user of the conveyor in this country—Mr. Shoubridge; and we find him at the Glasgow Engineering Congress, in the discussion on Mr. W. R. Chester's paper, saying that his experience with the De Brouwer conveyor was that "it worked exceedingly satisfactorily." "It had only been working about eighteen months; and the first renewals were now being made. . . . He could not imagine they would be more than was given for the form of coke-conveyor Mr. Chester had shown." Then at the Midland Association meeting in October, we have Mr. Henry Hack saying: "I cannot express myself too favourably of the efficient way in which the De Brouwer installation deals with the coke, either on the level or up an incline; but the wear and tear is far greater than I had anticipated. . . . Although the arrangement is so simple that the renewals are much less costly than in the more complicated system of pans, rollers, &c., my advice is that with this system no one must expect the parts just before named [chains, angles, and false-bottom plates] to last more than twelve months' working." Now on this last point as to the wear and tear, we must pause in our extracts to make just one comment; and it is that Mr. Hack, in conjunction with his estimate as to the time duration before renewal is required, did not stay to explain the particularly heavy nature of the work with which the Nechells conveyor has to deal. The house is 324 feet long, and contains four benches of thirteen settings of eights, calculated to produce a minimum of 5 million cubic feet of gas a day with all the retorts in action. Now it is hardly necessary for us to point out that the wear and tear on plant transmitting coke the length of this house, and considering also the immense quantity produced, is bound to be somewhat of a high order. To complete our reference to published testimony, we have Mr. H. Townsend telling the Manchester Institution last Saturday week that the conveying plant at Wakefield "works admirably, and is much esteemed by the stokers." However, "I expect that the wear and tear will be pretty heavy; but, so far, we have not had it working long enough to form a reliable opinion." Later on he mentioned that the saving in labour by its use would be considerable, as it cost above £20 per week last winter to get the coke removed and stacked. It is something for plant of this character, dealing with red-hot, friable, and cutting material such as coke, to earn straightway from its start such a reputation, as is indicated in our quotations, for reliability in working.

So much, however, for actual and anticipated experience, which brings us to the point first as to the alleged propensity of the conveyor for making breeze. When the Midland members were at Nechells, there was a good deal of side conversation on this question of the large proportion of breeze exposed to view; but no one among the visitors appeared to be able to arrive at any conclusion as to whether the reduction of the coke occurred while on the De Brouwer conveyor or after it left it. But, on this point, we have the information that in works where the breeze produced has been accurately ascertained both before and after the use of the conveyor, it is proved that the difference is very little. Of course, it must not be overlooked that the conveyor delivers its breeze in bulk, and so gives one the impression of being considerable, while that produced in ordinary working is taken away by unobtrusive barrow-loads.

However, Mr. Townsend, while praising the working of his plant, has perhaps made the most pronounced assertion in regard to breeze-making and breakage of the coke by the conveyor. Now we will suggest to Mr. Townsend that really very little breakage occurs while the coke remains on the conveyor, but that the point where it particularly occurs in his plant is in the screens, or as it drops the height at which he has his radial conveyor for distributing the coke on to his storage ground. This is merely a suggestion; but it is based on what we observed at Wakefield, and on the common-sense reasoning that a material like coke tumbling about in a screen and dropping either from a height or on to a high heap of coke and rolling down the sides must contribute largely to the formation of breeze. We find something in the way of proofs as to the accuracy of our suggestion. First, we turn to the discussion on Mr. Townsend's paper at the Manchester Institution meeting, and find there that Mr. Isaac Carr (who never minces matters when he has formed a view on any subject) had, judging from the tone of his remarks, come to the meeting with the intention of—shall we say—scoffing at the principle on which the conveyor is constructed, but, after a full examination, he remained to—well, not pray for it, but to speak in terms of high commendation. He expected, he said, to find the "cross bars would have crushed the coke to a very considerable extent. He was surprised, however, to see that the small pieces of coke were passing along to the place where they were dropped out without being crushed in any way." And now we appeal to one of the photographs which we published last week in support of our suggestion as to the screen itself being the greater sinner in respect to the production of breeze; and the illustration is so interesting in connection with this point that we reproduce it. It gives a view of the outside conveyor, which is capable of depositing the coke over a radius of 80 feet. The coke which is shown on the conveyor has passed through the screen before travelling along to the point at which it is about to drop to the ground; and we ask (magnify the photograph as one will) whether there is anything there which suggests a gluttonous activity on the part of the conveyor for grinding up the coke? We fail to detect anything. If there is an inordinate amount of breeze after the coke leaves this section of the conveyor, then we further suggest that the height of the conveyor is responsible, and if it was furnished with hoppers for delivery into carts, there would not be this liability to further breeze-making. To screen the coke once, then drop it to the ground, and then load it into carts with forks is subjecting the coke to a greater amount of rude treatment than it deserves or its constitution will permit; and it naturally follows that such treatment must have a wasting and impairing effect. In short, our argument or suggestion is that it is not the conveyor *per se* which causes the additional (if additional) make of breeze, but the conjunctive methods of dealing with the coke; and there, we think, is where engineers must seek improvement. The point is left for the further consideration of those who are using this type of conveyor; and perhaps, when convenient, the gas profession will be favoured by them with their further views.

The point upon which we cannot speak with any independence is that as to wear and tear; and we have therefore consulted the makers. Their reply is interesting, as it discloses their faith in the plant. They say: "We are daily finding means of reducing the wear and tear to more reasonable limits. However, wear and tear need not trouble the minds of the gas industry in the least, as we are prepared to undertake, for a set annual sum, to keep the conveyor in good working order, and supply all wearing parts for a term of years, so convinced are we from experience that the conveyor has come to stay." We have Mr. Shoubridge's remarks at the Glasgow congress on the subject of wear and tear; We have Mr. Hack's statement as to the simplicity of the conveyor, and the readiness with which the parts can be renewed; and we have Mr. Townsend's declaration as to the cost of his coke



removal last year, which gives him a wide margin for interest and upkeep. When all the coke, in one case, from 25 through beds of retorts can be removed, screened, and delivered into hoppers by the employment of one engine-driver per shift, there must be a large margin; and when the coke from 52 beds of inclined retorts, as in another case, can be dealt with in the same way by two men per shift, the means by which this can be done seems worthy of something more than passing attention.

All of this we have written (as already said) in the interests of fair play, and not by any means with the view of damaging the claims of the many other types of conveyors, whose work is such that they have a right to an equal consideration with the De Brouwer at the hands of an engineer who is proposing the adoption of some method of mechanically removing the spent charges from his retort-house. Coke-conveying is with us in many forms; and until coal carbonization under present conditions passes away, so long will several of these forms of conveyor be found economically carrying on an arduous part of the resulting work.

ELECTRIC LIGHTING MEMORANDA.

The Burden of Bath—Breakdown of the Light and Dismissal of the Electric Lighting Committee—An Alleged Bankrupt Concern—A Hard Nut for Municipalizers.

THE foreboding recently expressed in the "JOURNAL" in regard to the impending fate of many of the smaller electricity supply undertakings in the United Kingdom, especially those belonging to local authorities, has not waited long for justification. The electric lighting affairs of the Corporation of the City of Bath are in a bad way—so bad, that the Electric Lighting Committee have been dismissed, and the whole body of the City Council has been resolved into an Electric Lighting Committee, meeting *in camerâ*. This dramatic climax to a fairly long spell of municipal trading in electric light was brought about by the initiative of Mr. Councillor Moger, who we understand to be a banker of the city. It was time. Previously to the moving of his resolution by Mr. Moger, the City Council had received an important deputation of representative citizens asking that the old Electric Lighting Committee might be relieved of their functions, for the reason that nothing which emanated from them would command respect in the city. The annals of English local government might be searched long before a parallel could be found for such a remarkable transaction. Unless we are sadly mistaken, there will be many like it before much time has elapsed. The Bath bubble has been the first to burst; that is its sole claim to any special distinction.

The Bath City Council met last Tuesday, the 3rd inst., under the presidency of the Mayor, Mr. E. E. Phillips. It is advisable to be circumstantial about all this, because if the occasion had been one for the glorification of electric lighting, or any other branch of municipal trading, it would have been advertised far and wide in all the periodicals attached to the cause. As it was the direct opposite of this, the facts are not likely to be found recorded elsewhere than in the local newspapers, and in our own columns. A deputation of citizens, as already mentioned, attended the meeting, with the object of impressing upon the Corporation the profound dissatisfaction of the ratepayers with the electric lighting enterprise of the Corporation from the commencement. Matters were brought to a head by the complete breakdown of the service on the 18th ult.; but this occurrence was treated by the spokesman of the deputation, Mr. Austin J. King, as merely an incident. The real trouble is much more serious and deep seated. The collapse revealed the existence of a rotten condition of works and cables. The distributing network has failed in its insulation, after twelve years' use; and the electrical plant at the station has broken down, with the deplorable consequences stated.

Worse than these works difficulties, however, is the condition of the finances. The Electric Lighting Committee had overdrawn their banking account so heavily, that the bankers were compelled to warn the Corporation that they could not go on honouring cheques indefinitely without proper security. The accounts of the Committee appear to have been kept back. The last analysis published in the "Electrician" was on April 20, 1900. Mr. King states that the financial condition of the undertaking is far worse than the accounts show, unfavourable as they are. The property was originally created by the historic Mr. Massingham, who, in the eighties, went forth from Bath to plant out electric lighting by central stations throughout the West of England. His name is not now held in esteem as that of a public benefactor. The old Bath Company was bought up by the "public-spirited" Corporation of that day for £24,500; and £56,600 was immediately expended on the undertaking. The response to the additional outlay of capital for "extensions" was an increase of revenue of £1225. The first year after the undertaking was transferred, there was a profit of £645. That was as the concern was managed by the Company. The profit was smaller than it had been before; but it was the last the Corporation ever made. During the next three years, £3176 was drawn from the rates. Desperate attempts were made to find business for the concern by going in for street lighting; but this, of course, is not trade. Now the Committee owe the bank £9000 without having any authority to pledge the city's credit. Their capital loans amount to £81,000; and it is doubtful what the works are really worth.

This is how Mr. King put the matter before the City Council; and professional municipalizers may safely be challenged to confute him. After making his special complaint, he said: "Take the matter generally. He thought it would be common ground to all of them that municipal trading could never be justified unless it could be conscious (*sic*) that a direct profit or an indirect advantage came to the city through it; and he should certainly hope to show them that in that case there had been no such profit, that they could not hope for any profit, and that there had not been the indirect advantage which they, as ratepayers and as citizens had a right to expect from the embarkation in a trading enterprise by a creditable city." The wording of the report is evidently imperfect; but we give it as it stands in the "Bath Herald" for the 3rd inst. The meaning is plain enough.

Now, perhaps, the perfervid persons who are always blowing up the trumpet for municipal trading will be so kind as to give a little of their valuable time and attention to the case of Bath. What was wrong with this field for a municipalizing experiment? Mr. King is of opinion that it is not right to expect of the average town councillor the scientific knowledge and skill in the conduct of a manufacturing business which must go to the successful undertaking of electricity supply. The consequence of doing so in this instance is, in the opinion of Mr. Councillor Dickenson, M.P., that the City Council, when they have got to the bottom of the existing trouble, "will find it best, having made a bad debt, to write it off, and make an end of their connection with the electric light." Another Councillor, Mr. Hall, declared that the undertaking is a "bankrupt concern," and accused the old Committee of having followed a policy of patching, when the proper course was "to have thrown the lot on the scrap heap." After this plain speaking, the City Council, by 28 votes to 8, carried Mr. Moger's amendment superseding the Committee.

THE GAS AND WATER STOCK MARKET.

IT is pleasing to be able to chronicle an improvement in the condition of things on the Stock Exchange. Not that there was any great outburst of activity; for when things have almost rusted into fixtures, they do not recover elasticity all at once. But there was a decidedly more cheerful feeling prevalent generally. This was the result of a number of satisfactory incidents, chief among which was the evidence of marked progress towards the termination of the war. Prices in important markets were appreciably higher; and Consols had quite a jump when it became understood that there would be no further issue to meet the next instalment of war expenses. The Money Market was much easier; and the supply was abundantly adequate to meet all demands. The Gas Market had another quiet and very uneventful period; business jogging along in a humdrum sort of manner, with hardly any change or sign of an approaching change, with the sole exception of one issue. Prices have scarcely moved either in the town or in the country Exchanges. But the general tendency seems buoyant; and when any stocks are offered in the Mart, they are taken up quickly enough. Gaslight and Coke issues were quieter on the whole, although on one or two days they brisked up a bit. The ordinary stock was steady and unchanged at about middle figures, or within a fraction of them; and practically the same thing may be said of the secured issues. In South Metropolitan, there were a more than usually large number of transactions. At first, it looked as if the quotation must go down a point; but subsequently there was a bit of a rally, and the mark on the closing day was as good as any in the week. One single bargain in Commercial old was all that was done in it. Stock is not plentiful; and any that offers is readily taken by good buyers. In the Suburban and Provincial group, there was almost absolutely nothing doing in the London market; and quotations stood undisturbed. But in their local Exchanges, Bristol was a fraction easier, and Newcastle debentures advanced a couple of points. In the Continental Companies, there was weakness. Union and European did not move; but Imperial receded appreciably, and Tuscan had a fall. Among the remoter undertakings, there was nothing at all to notice. Transactions in the Water Companies exhibited their usual moderation. There was only one move in quotation; but it was a large one—Chelsea gaining more than 10 points. New River shares were marked as low as 397; but in the Mart on Wednesday, the same shares by auction were realizing 430—another instance of the discrepancy between Capel Court and Tokenhouse Yard prices.

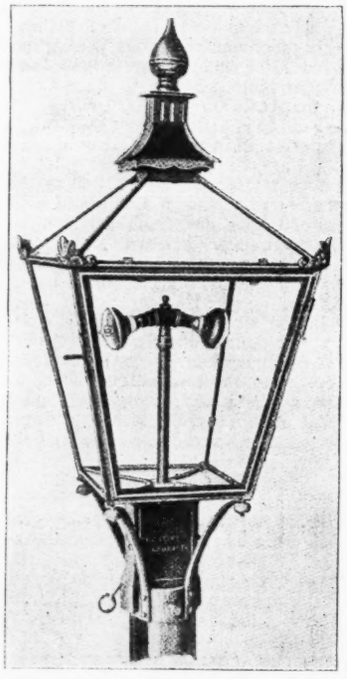
The daily operations were so uniform, and prices were so level and unvarying for the most part, that they may be dealt with briefly. On Tuesday, Tuscan Gas fell ½; but Chelsea Water rose 5. On Wednesday, Imperial Continental fell 2. On Saturday, Imperial Continental had another fall of 2; but Chelsea Water rose 5½.

THE SEASON'S ELECTRIC LIGHT APPLIANCES

IT is plainly a matter of importance for gas lighting engineers to be acquainted with the newest improvements and developments of electricity supply and electric lighting appliances; and therefore a considerable degree of interest attaches to a recent account, published in the "Electrical Review," of the electrical novelties of the present lighting season. The statement commences by an

admission that the electric lighting season is in full swing, and stating that manufacturers of, as well as dealers in, electric lighting fittings are doing a pretty brisk business. When one proceeds to investigate the nature and quality of the "leading lines" which manufacturers of these specialities are placing upon the market, however, the first impression received is one of disappointment at the lack of striking novelties. There are no "Nernst" or Osmium lamps in the list. Indeed, a prominent exhibit is that of the Edison incandescent lamps, for which the British Thomson-Houston Company, of Rugby, are the English agents. Since the annual production of these lamps is stated to be over 15 millions, the force of standardization must be supposed to have attained its full value in their regard; and no trade rivals seem to be greatly dreaded. If this is not evidence that the manufacture of incandescent electric lamps has come to a standstill in the attempt after perfection, it shows that faith in the possibility of further advances in this direction is not held by the largest makers. It is stated, as an indication of their excellence, that these Edison lamps undergo fifty constructive operations and forty separate tests before coming into the hands of the user. Figures are quoted by the agents to prove what is well known to the electrical engineer, but often enough neglected by the consumer, that there is no economy in continuing lamps in use after 600 hours. It is insisted upon that long life ought not to be the sole concern when selecting an incandescent lamp. It is as well to know what those best qualified to speak on the subject think of the durability of incandescent electric lamps. A lifetime of 600 hours is very fair; but it does not warrant electricians talking disdainfully of Welsbach mantles in ordinary use.

There is nothing new in the shape of electric incandescent lamp fittings. Somebody makes what he calls a "sunshine" lamp, which is simply a lamp with a detachable opal glass reflecting cap made to fit loosely over the upper part of it, when used for street lighting. The idea is that one of these reflectors will last out any number of lamp renewals—which is probably true. On the other hand, another manufacturing firm adheres to the pattern of so-called improved incandescent lamps which has one half of the bulb silvered for reflecting purposes. This idea is commended in the columns of our contemporary on the authority of an American, Professor Rowland, who is credited with having "pointed out that the lamp which is of the greatest effective value is not that with equal luminosity in all directions, but the one which concentrates its rays below the horizontal plane; for the maximum illumination is required, in most cases, not on the walls and ceilings, but on objects which are but a few feet from the floor." This brilliant discovery does not strike one as particularly fresh. It has, however, been chosen as the reason for the existence of the reflector lamp, which, we are told, by slow and almost imperceptible degrees has been brought to a high state of perfection. For example, one of these lamps, selected at random, is credited with a duty of over 80-candle power towards the top with the aid of a reflector, but when denuded of the silver proved to give less than 16-candle power. We are carefully informed that "no actual increase of light-emission is claimed for the lamps; the point is that the rays are directed in the most useful path. For instance, in street lighting it is desirable to illuminate not merely the area adjacent to the lamp-post, but also that midway between two posts;" and this object is supposed to be attained, as shown in the accompanying figure of a converted gas-lantern, by fixing the lamps at such an angle that the light is thrown towards the next posts. "The rays from two adjacent lamps, overlapping midway between them, combine to produce a powerful and fairly uniform illuminant from post to post." The special recommendation of this particular pattern of reflector lamp is that it is desirable to employ a reflector subtending a very large angle, which can be accomplished by the system of combining the reflector with the lamp itself without requiring the reflector to be of excessive dimensions. Moreover, the silver can never become tarnished, as it is in actual contact with the glass.



Converted Gas-Lantern with Improved Glow Lamps.

We have never yet criticized this particular make of reflector electric incandescent lamp; but since it is being advocated as an improvement upon the normal and proper use of a gas-lantern for street lighting purposes, it may be expedient to bestow this attention upon it. It may be left to those in the trade to fight out the question of whether the combination of reflector and lamp-bulb is an economical arrangement. We should be disposed to favour the view that it is a wasteful plan to combine the reflector, which is a permanent feature, with the lamp itself, which is a perishable article that wears out quickly in use. The annual charge for renewals must be increased thereby. Apart from this particular question, it should scarcely be necessary to remark that the practice of introducing the element of reflection into street lighting appliances is antiquated. It survives in good modern general practice only in the modified form of partial reflection from translucent (not absolutely opaque) surfaces, and these of relatively small size. There are special examples in which the complete stoppage of light in some direction, and its reflection in others, are desirable; but as a rule, this disposition is recognized as being objectionable in ordinary public street lighting. The reason for this objection to totally reflected or focussed street lights is twofold. In the first place, the light is really wanted all round. It cannot be truthfully contended that the ordinary street-lamps need be more brilliant in one direction below the horizontal through the flame than in another, so as to warrant their being focussed in this sense at the expense of others. The question of the utility of the proportion of light that radiates above the horizontal plane through the flame or light-source is a very old subject of debate. Many years ago, lanterns were made entirely closed on the top, with a view to stopping this overhead radiation; but the effect was funereal. In busy streets it has long been perceived that the reasonable illumination of the upper frontages makes for cheerfulness. Consequently, the modern street gas-lantern has an opal glass top reflector; and even the electric arc lamp-globe for street use is made larger than the superimposed cylinder which contains the works.

This rule holds good even in clear weather; while in times of fog, when the part played by street-lamps is altogether changed, reflectors are worse than useless. At such times the best lamp cannot be said to light anything, but has merely to make itself visible at the greatest possible distance. Then the all-round light beats the focussed light, whatever the nominal candle power of the concentration beam. This matter of the candle power of the focussed beam is very illusory. We are told that the reflector incandescent electric lamp makes a beam of 80-candle power out of a filament of only 16-candle power without the silver reflector. What of it? It is only a bad case of robbing Peter to pay Paul. The surface of the luminous sphere produced by a lighting point is (by geometry) 12·7 times unity. That is to say, if we could concentrate the whole of the luminous radiation of one candle in every direction, upon one point of spherical surrounding space, it would measure 12·7 times the simple radial measurement of the illuminating effect at the same distance. Obviously, this degree of concentration is impossible. No reflecting surface gives back the whole of the incident light; and we cannot focus all the spherical radiation in a beam of no magnitude. But, clearly, in whatever degree this concentration of light in a beam is attempted, the total amount of spherical radiation is correspondingly trenched upon. And not merely in the theoretical proportion, but so much in excess, as the means employed are wasteful and imperfectly designed. Thus, in order to raise a simple radiation, in one line, from 16 to 80 candles, it is probably necessary to borrow very much more than the surplus of 80 − 16 = 64 candles, from the total available spherical radiation. The net result is that when the whole thing is surrounded by a light-absorbing medium, such as fog, the light which has a reflector of such magnitude attached to it will be obscured at far less range than an open light of the same intrinsic brilliancy. In short, all opaque reflectors are also extinguishers.

In other respects, the so-called electrical novelties for the present lighting season do not call for remark. No progress has been made in realizing a style of interior light-fitting distinctive of electricity. From hall-lanterns to drawing-room standard lamps, the fittings ape gas or oil where they do not caricature candles. There are a few survivals in electric cooking and heating appliances; but nothing in any way to reverse the judgment of the Crompton Company in writing off all such toys as extravagant rubbish.

Forced Draught.—Dealing with this subject in "Cassier's Magazine" for this month, Mr. W. H. Booth points out that one of the most useful applications of fan draught is to augment the capacity of existing boiler plant. The plant may perhaps have been added to until it is entirely beyond the capacity of the old chimney, and the draught is poor and sluggish. At once the boiler fires can be brightened up, and one or two boilers perhaps laid off, simply through the aid of a fan. A chimney obtains its power by virtue solely of its internal high temperature. It is computed that, under ordinary conditions, an internal temperature of 500° Fahr. will produce as good a draught with a chimney of 100 feet as would be obtained by a chimney of 175 feet with an internal temperature of 250°. With a fan this is reversed. The cooler gases demand the smaller fan. It is productive of a double effect to add more economizer surface, because the waste gases are further cooled thereby, and the fan action is found to be considerably improved.

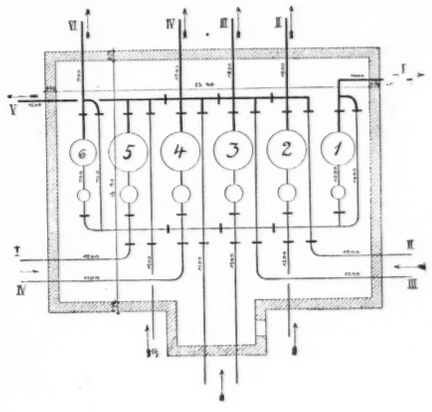
THE VIENNA MUNICIPAL GAS-WORKS.

(*Continued from p.* 1442.)

Pressure Regulation.

The gasholders of the works may throw pressures ranging up to 8·4 inches of water. The regulation of the pressure involved the task of maintaining automatically a uniform pressure in the outlet mains from the works, notwithstanding changes in the position of the gasholder bells and variations in the consumption. The gas on its way to the distributing system of the city takes the course naturally indicated by the disposition of the country—*i.e.*, along the Danube Canal and the Vienna River; but it traverses six separate trunk mains, according to the levels of the different parts of the city. Four of these trunk mains are 48 inches in diameter, one is 39 inches, and the remaining one 27½ inches.

The governor-house stands on a piece of ground of limited area on the north side of the gasholders, between Nos. 2 and 3, as is shown in the plan of the holders on Plate II. The stairs and telephone office are in the vestibule. The governor-room is 77 ft. 1½ in. long and 60 ft. 8 in. wide. The roof, the structure of which is open to view from within, stands 19 ft. 8 in. above the floor, which is supported on girders and an iron framework. The cellar below is 13 ft. 5 in. high, and contains, exposed and readily accessible, the gas-mains, and water, steam, and hydraulic power services (see accompanying plan).

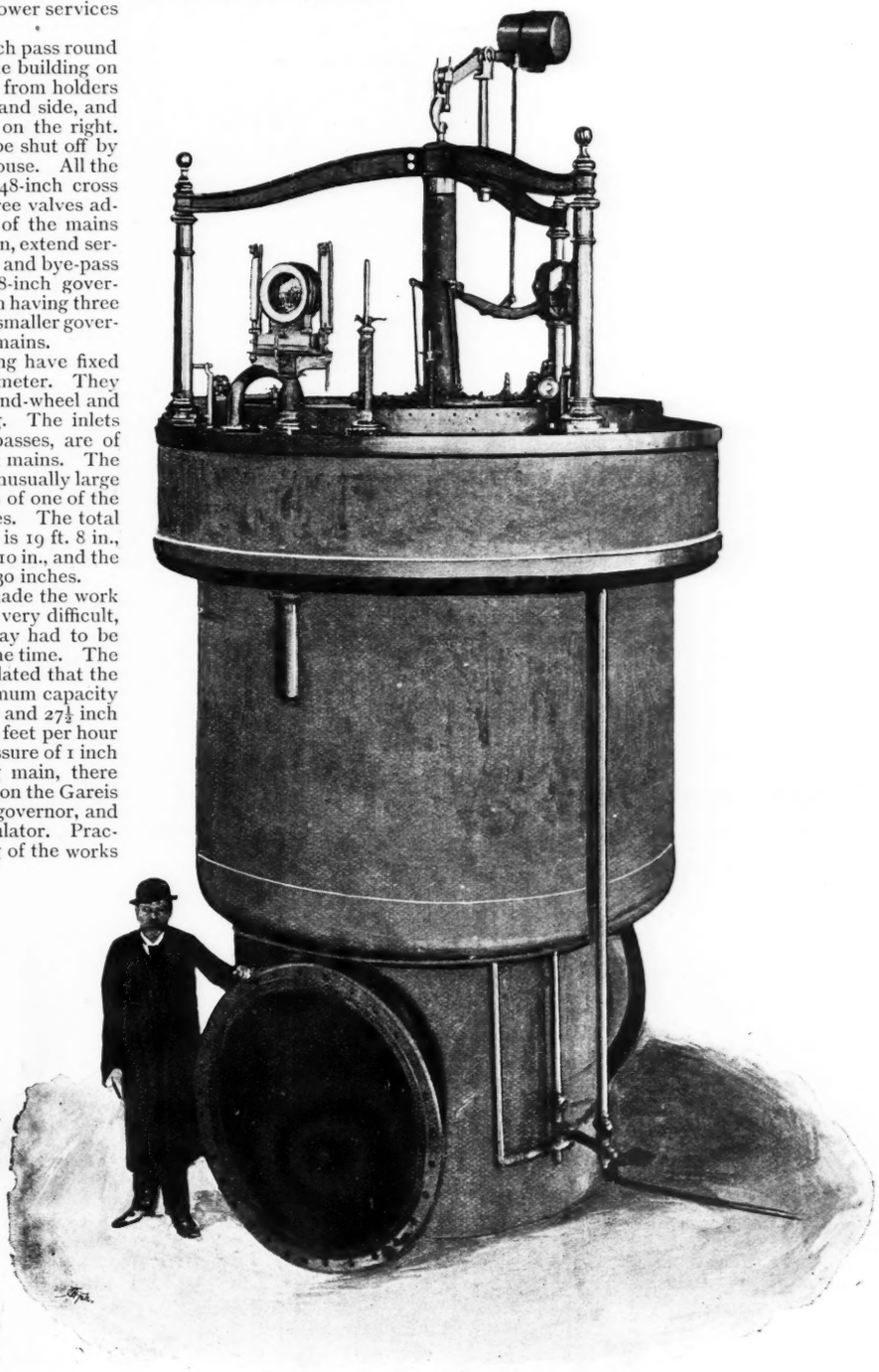


Plan of Cellar Below the Governor House.

The four 48-inch gas-mains, which pass round and bye-pass the holders, enter the building on its south side. The outlet mains from holders Nos. 1 and 4 enter on the left-hand side, and those from holders Nos. 2 and 3 on the right. Either of these eight mains can be shut off by valves fixed at their entry to the house. All the mains are then connected by a 48-inch cross main, in which there are fixed three valves admitting of different combinations of the mains being made. From this cross main, extend services leading to the six governors and bye-pass mains. The outlets from the 48-inch governors are connected by a cross main having three valves. The outlets from the two smaller governors lead direct to the distributing mains.

All the 32 valves in the building have fixed spindles, 3¼ inch in external diameter. They are moved by means of a small hand-wheel and bevel-wheel transmission gearing. The inlets to the governors, and the bye-passes, are of the same diameter as the outlet mains. The apparatus consequently attains unusually large dimensions, as the annexed figure of one of the 48-inch station governors indicates. The total height of each of these governors is 19 ft. 8 in., the diameter of the casing is 9 ft. 10 in., and the valves have openings of 28⅓ and 30 inches.

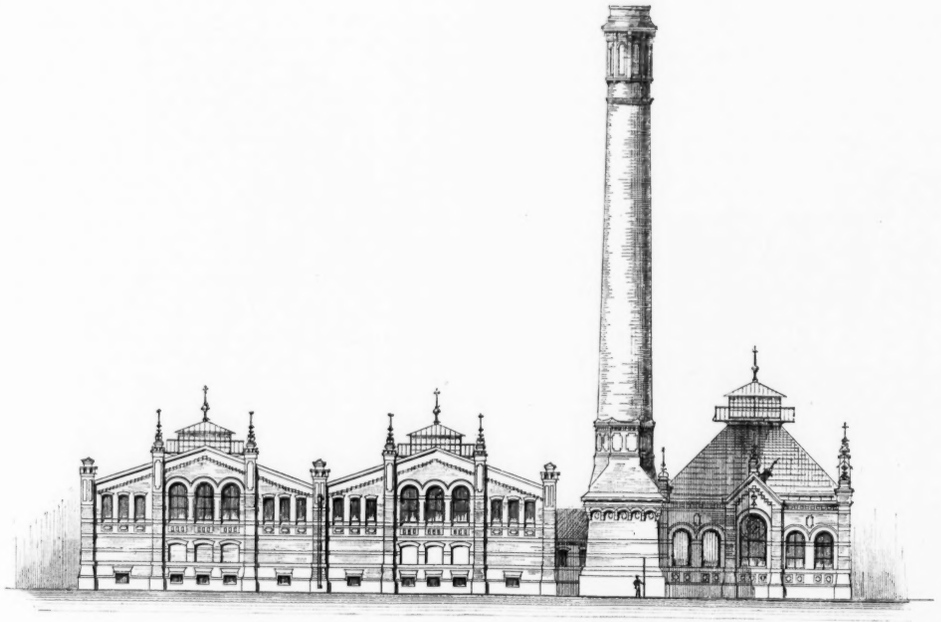
The limited space at disposal made the work of equipping the governor-house very difficult, especially as the adjacent roadway had to be kept open for traffic throughout the time. The contracts for the governors stipulated that the 48-inch size should have a minimum capacity of 620,000 cubic feet, and the 39 and 27½ inch sizes of 400,000 and 198,000 cubic feet per hour respectively, with a minimum pressure of 1 inch of water. For each distributing main, there are provided two governors, both on the Gareis system. One serves as an initial governor, and the other as the true pressure regulator. Practical experience since the opening of the works has shown that the initial governor may be shut out constantly without any undue amount of work being thrown on the pressure regulator, especially when all four gasholders are simultaneously delivering gas. The pressure regulators proper serve, almost independently, to regulate the pressure satisfactorily in the different districts supplied by the six trunk mains, which are shut off from one another by valves.



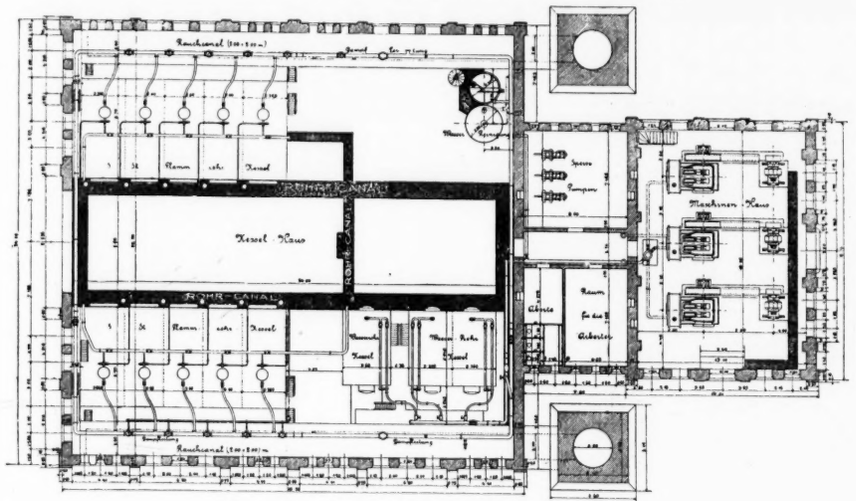
One of the 48-Inch Governors

Water Supply, Drainage, and Works' Mains.

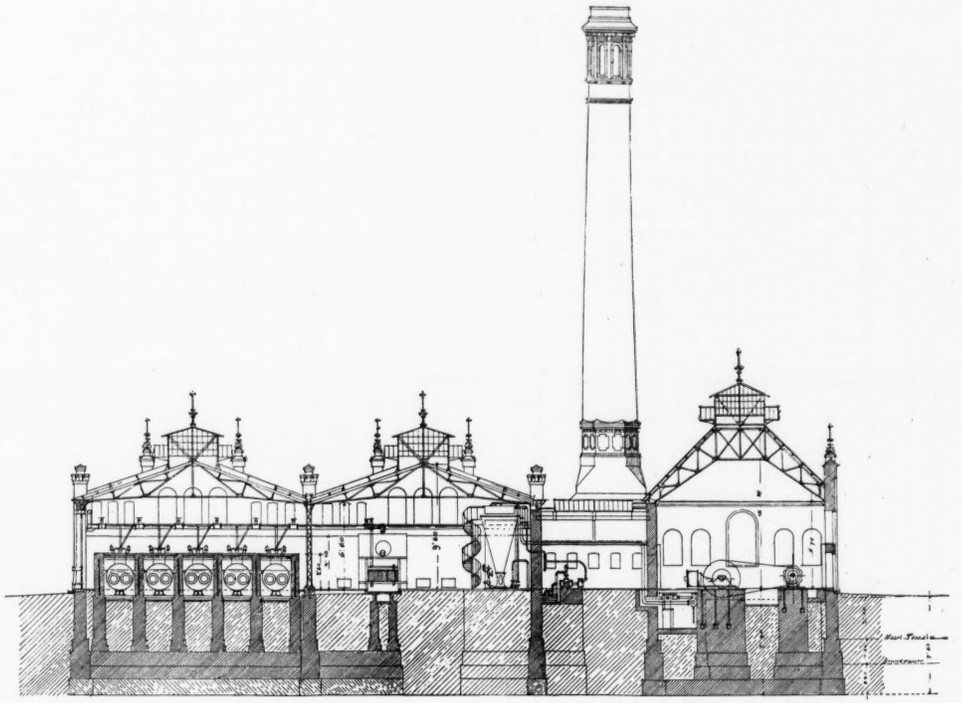
The clean-water service-pipes have a length of 9190 feet, and are supplied from the deep well mains of the city. On the gas-works, the pressure of this supply is 3 atmospheres. The principal clean-water main on the works is 4⅛ inches in diameter. There are 58 taps and 12 fire-hydrants on the clean-water service. The washers are also supplied from it.



End View of the Boiler and Engine House.



Plan of the Engine and Boiler House.



Cross Section of the Boiler and Engine House.

The works' water supply is derived from two wells, 13 feet in diameter and 29 ft. 6 in. deep. They were dug in the spots which trial borings indicated as the most suitable. Three Worthington pumps, each capable of pumping 660 gallons per minute, to a height of 130 feet, are used to raise the water and force it through two mains, 8¼ inches in diameter, to one receiving main, 12⅜ inches in diameter. This supplies some service-pipes directly, but takes the bulk of the water to the tower reservoir. This Intze reservoir is in a brick tower in front of the retort-house, and has a diameter of 23 feet and a depth of 27 ft. 6 in. Its available capacity is 55,000 gallons. It stands 67 ft. 6 in. from the ground. The inlet and outlet pipes are so connected that it is possible, in case of necessity, to shut the reservoir out of action. The distributing mains of the works' water service are about 13,000 feet in length.

The sewer for taking away waste water and sewage from the works joins the main-drain for the Eleventh District of the city, which passes through the gas-works. The principal works' drain is made of concrete, and is 3830 yards in length. Branch drains of earthenware, having a length of 2735 yards, run into it. As the yard level of the works is only 1 foot above the high-water mark of the Danube Canal, provision was made for shutting off the drainage system in order to guard against any risk of floods through a rush of water back through the sewer. When the sewer is closed in this manner, its contents would, of course, have to be pumped away.

The gas-mains connecting the different pieces of apparatus on the works, &c., have a total length of 17,700 feet, of which 10,500 feet is of 48 inches diameter, and 3280 feet of 39 inches diameter; while the remainder is 35½ inches in diameter. The laying of the works' mains was attended with great difficulties, both because of the bad nature of the subsoil and because it had to be carried out before the material for raising the ground level was shot. Hence as many as 500 workmen had to be engaged at one time on this branch of the work, in order to get it finished quickly. To avoid any risk of the mains on the works being floated up in the event of floods, all of them were loaded with concrete blocks. The mains were, of course, arranged in four sections, in accordance with the general plan of the works.

With a make of 445,000 cubic feet per hour per section, and a positive pressure of 0·08 inch at the inlets of the exhausters, the following losses of pressure were found between different parts of the plant: Between the outlet of the retort-house and the inlet of the condenser-house, 0·30 inch; between the inlet and outlet of the condenser-house, 0·08 inch; between the inlet and outlet of the tar-extractors, 3·15 inches; between the inlet and outlet of the washers, 0·83 inch; between the inlet and outlet of the purifiers 2·50 inches; and between the inlet and outlet of the station meters, 0·70 inch.

In the different buildings on the works, the various pipes—*i.e.*, drinking water, works' water, hydraulic power, liquor mains, &c.—are painted in different colours, in order to prevent any confusion.

Boiler and Engine Houses.

The engines on the gas-works are driven partly by steam and partly by direct electric current. The heating of all the rooms, except the dwelling houses, dining hall, and official rooms, is carried out by means of steam from one centre. The lighting of rooms or buildings in which an explosive mixture of gas might occur is by means of incandescent electric lamps; but with outside gas-lamps as a reserve in case of need. The coke and coal yards are lighted by electric arc lamps as well as by gas.

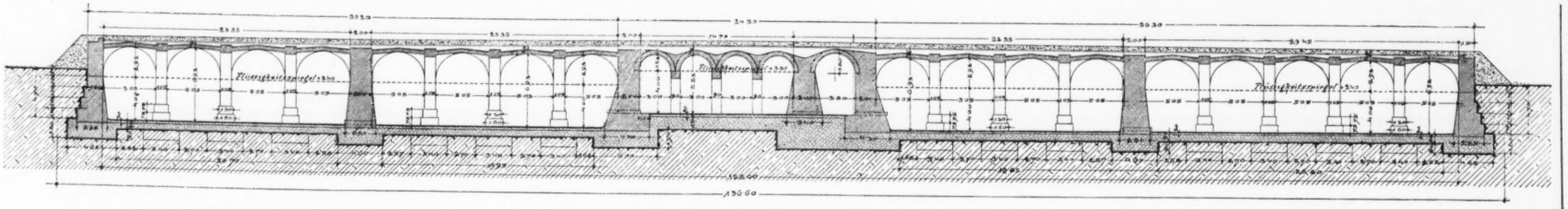
Three compound engines, each of 200-horse power, are used for generating the electric current. The steam for these engines is derived from three water-tube boilers, working at a pressure of 12 atmospheres. The steam for other purposes is obtained from ten Cornish type of boilers, working at a pressure of 6 atmospheres. The maximum consumption of steam per hour was computed to be 6 metric tons at the high pressure, and 5 to 10 metric tons at the low pressure. The boiler-house stands between the condenser and washer houses, and at the back of the exhauster-house, from which it is separated by a roadway. The fuel is brought up to the stokers by means of small trucks running on tramway metals on this road. The engine-house for generating the electric current adjoins the boiler-house, and communicates with it by a gangway. Between the two are rooms for the feed-pumps, workshops and lavatories, and lobbies for the enginemen and stokers. The boiler-house has a total length of 111 ft. 6 in., and a width of 106 ft. 7 in., inside measurement. It is divided into halves by a gangway, 32 ft. 6 in. wide, which serves as a stoking floor and coal-store. On the south side are the three water-tube boilers, and five Cornish boilers; on the north side, the remaining five Cornish boilers, and a water-softening plant. Space remains for three or five boilers.

Interior of the Boiler and Engine House.

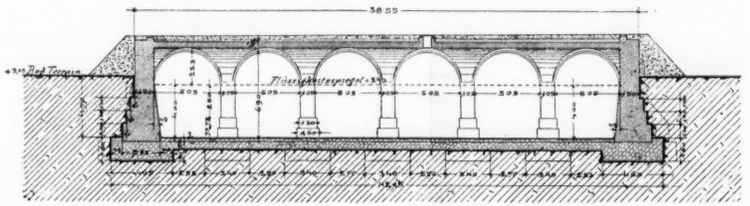
On each side of the building is a main flue, 43 square feet in cross section, leading to the two chimney shafts, each 147 ft. 8 in. high, 9 ft. 10 in. diameter at the bottom, and 8 ft. 2½ in. at the top, internally. The foundation of each shaft is a concrete bed nearly 28 feet square and 7 ft. 6 in. deep, set at a depth of 26 ft. 3 in. below the ground level The walls of each chimney are nearly 18 inches thick at its base, and nearly 10 inches thick at its top. All the boilers have undergrate blowers, and are adapted for consuming coke breeze. But the chimneys give so good a draught, that the blowers under the grates are not ordinarily used. The breeze is scarcely saleable, even at a low price, on the works, and in the boilers it evaporates four times its weight of water.

Each of the Cornish boilers has a heating surface of 753 square feet, and a grate area of 31½ square feet. Hence the ratio of grate area to heating surface is as 1 to 24. Though the bars of the grate are placed with only $\frac{3}{10}$ inch clearance between them, nevertheless a good deal of the dusty fuel falls through them into the ash-pit. Five of these boilers were guaranteed by the makers, with an allowance of 3·07 lbs. per square foot of heating surface per hour, to utilize 70 per cent. of the fuel, and to give a maximum duty of 1·5 metric tons of steam per boiler per hour. The other five boilers, made by another firm, were guaranteed similarly for only 68 per cent., and 1·4 metric tons; a deduction of £16 15s. to be made from the price for each 1 per cent., or part thereof, by which a boiler failed to reach the stated utilization of the fuel, and for each 2·2 lbs. by which it fell short of the maximum duty guaranteed. Trials showed an evaporative power of four times its weight of water with coke dust, and 4·9 times with coke breeze; but these figures are not quite attained in ordinary working. The three water-tube boilers were each to give a maximum duty of 1·5 metric tons of steam at 12 atmospheres pressure per hour.

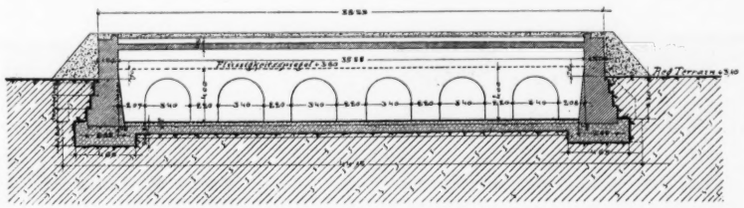
Beneath the stoking floor is a concrete tank for the feed water, which is pumped by three Monsky feed-pumps, driven by either the high or the low pressure steam into two pipes, 4 inches in diameter, running in a circle under the floor, and having 2·4 inch feed pipes branching off to each boiler. Valves between the feed pipes enable any boiler to be shut out. There are three circular sets of pipes for conveying the steam from the boilers. One pipe, 10 inches in diameter, running round the walls of the boiler-house, takes the steam from the rear steam-pipes of the ten Cornish boilers for driving the pumps, heating all the apparatus houses, the cups of the gasholders, and the purifier-house. Then, nearly



LONGITUDINAL SECTION OF THE TAR AND LIQUOR TANKS.



TRANSVERSE SECTION OF THE TANK.



TRANSVERSE SECTION OF THE SEPARATING CHAMBER.

7 feet above the tops of the boilers runs a pipe, 5 inches in diameter, which receives the steam from the fore steam-pipes of the Cornish boilers, and serves the exhauster-house only. The third steam-pipe, 6·9 inches diameter, internally, receives the high-pressure steam for supplying the three large steam-engines, for the well and feed-water pumps, and for the steam-engine in the workshops. There are about 23,000 feet of steam-pipes, made of Mannesmann tubes, of which 2625 feet are supported by lattice columns and iron girders with spans 39 ft. 4 in. wide, and 164 feet are laid in masonry conduits. The remainder rest on brackets.

The ten coal-breakers and the band conveyors in the retort-house are worked by electric current instead of steam. Electric power also is employed on the second works' water well, which is at a distance and is to be kept in reserve, and also for a coke-breaking machine. There are three primary dynamos driven by engines developing 175 effective horse power, with an inlet pressure of 9 atmospheres and 6½ fold expansion. One at least is kept in reserve. They are driven by a belt from a wheel 8 ft. 10 in. in diameter, and 18¾ inches wide. The engines, at 175 effective horse power and 6½ fold expansion, consume 24·9 lbs. of dry steam per horse-power-hour.

The direct-current dynamos, at 175-horse power and 400 revolutions per minute, afford a duty of 120 kilowatts at a tension of 230 volts. There are 13,100 feet of conducting cable, 0·31 to 0·46 inch in diameter. The electromotors in the retort-house, at a tension of 200 volts and 850 revolutions per minute, yield 25 effective horse power. They are placed against the inner wall, in a well-closed casing, which communicates by openings with the outer air. Interruptions have not hitherto occurred, notwithstanding the coal dust and moisture in the retort-house.

The foundations of the boiler and engine house were carried to a depth of 26 ft. 3 in., as the subsoil here was mostly mud and shifting sand. After the walls were built, and while the foundations for the boilers and tanks were being prepared, the excavated interior was, to save time, provided with a special framing for erecting the roof structure. The roof stands 23 feet above the floor of the boiler-house, and is supported by a longitudinal girder and two lattice columns, which divide it into two halves, each with a span of 55 ft. 9 in. The roofing has large lights, and continuous lanterns for the sake of ventilation. A double glass light is provided in the roof of the engine-house, in order to prevent dripping of condensed water, as well as for the sake of the appearance of the building.

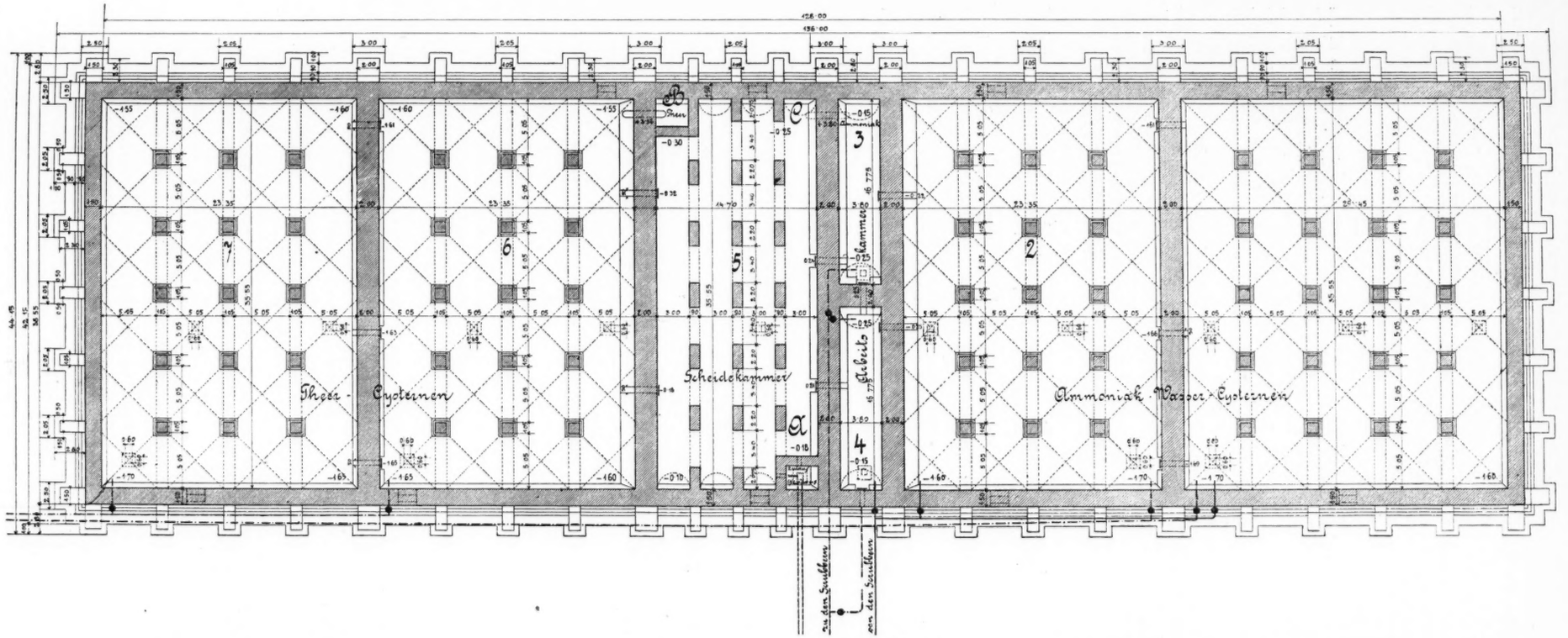
TAR AND LIQUOR TANKS AND PLANT.

The tar and liquor are received in group of tanks shown in the accompanying sketches, which have a total length of 420 feet and a width of 116 ft. 6 in. inside measurement. These tanks are in the space between the State Railway line and the main sewer of the Eleventh District of the city—that is to say, on the east side of the works, and in front of the apparatus houses (see plan of the works in the "JOURNAL" for Nov. 12, p. 1228). To the north lie the tar-handling plant and the liquor-works. It was originally intended to erect the liquor-works to the south of the liquor-tanks; but on a decision being arrived at to place the liquor-works in the hands of a private firm, it was thought best for them to be in the northern corner of the works. Consequently, long liquor mains from the tanks to the works became necessary.

In the middle of the tanks is the separating chamber, and to the north of this are two large tar-tanks (Nos. 6 and 7), each 76 ft. 6 in. by 116 ft. 6 in. To the south are the liquor-tanks, of which two (Nos. 3 and 4), next to the separating chamber, are those to and from which the liquor is worked. They are 12 ft. 5 in. wide. The two liquor storage tanks (Nos. 1 and 2) are 96 ft. 6 in. and 76 ft. 6 in. long respectively, and both 116 ft. 6 in. wide. All the four storage tanks are 22 ft. 9 in. high inside. The floor of these is nearly 5 feet lower than that of the separating and working chambers. At the bottom of the partition walls, between the chambers, openings, which may be closed by valves, are arranged. The two liquor storage tanks, when filled to a height of 13 ft. 2 in., contain 1,575,000 gallons; the two tar tanks, when filled to the same height, 1,350,000 gallons. The tar is disposed of to a number of works; so that only a small stock is kept.

The pipes used to convey the products of condensation from the preliminary collecting tanks and retort-house, deliver into the well A of the separating chamber (as shown), in which the liquor off-take C is arranged at a height of 13 ft. 2 in. from the bottom of the chamber. The liquor flows through C to the working tank No. 3. At a height of 11 ft. 8 in. from the bottom of the separating chamber is the outflow B, for the tar to tar-tank No. 6. This outflow is in a well (which the tar enters at the bottom) built in the separating chamber; so that liquor cannot pass over into the tar-tanks. The two working liquor tanks (Nos. 3 and 4) are connected by an opening in the partition wall, which may be closed by a valve. From these tanks weak liquor may be returned to the washers, and thence run back either into these chambers or direct to the storage tanks Nos. 1 and 2. The whole of the tanks are of brickwork, carried out with Portland cement mortar. They are arched over on pillars; the bottom of the tanks is a layer of concrete 35½ inches thick, except under the pillars, where the concrete is twice that thickness. There is a Portland cement rendering on both brickwork and concrete.

The condensation products from the retort-house are conveyed through a 16-inch cast-iron collecting main to the separating tank. The height of the retort-house outlet makes it possible to



PLAN OF THE TAR AND LIQUOR TANKS.

convey the tar thence direct to this tank. The main is nearly 790 feet long; and for nearly 560 feet of its length it is carried 13 to 16 feet above the ground on a wrought-iron girder framing, and for the rest of its length on the walls of the tanks. The condensation products from the condensers and washers are pumped from the preliminary receiving tanks to the separating and storing tanks through underground pipes.

The building in which the tar is handled contains a tower, at the top of which is a tar-reservoir, and on the ground floor two tar and two liquor steam-pumps. The tar-reservoir has two outlets. One serves for filling tank-waggons on a railway line below it, and the other leads to a special arrangement of pipes for filling smaller receptacles in a room provided for the retail trade.

The two liquor suction pumps draw the liquor from the large tanks, and force it into two concrete measuring tanks, each of 15,400 gallons capacity. From these it is delivered to the liquor works which have been erected, on a corner of the gas-works' land, by a private firm who have contracted to buy the liquor. These liquor works and plant, by agreement, become the absolute property of the Municipality at the end of a term of years, and may be taken over by them on certain conditions at an earlier date. The liquor is meantime purchased by the contracting firm at a price which is fixed by scale according to the prevailing market price of sulphate of ammonia. The gas-works agree to deliver the liquor to the liquor-works at a strength of at least 2° Beaumé. The liquor-works contain Feldmann's plant for the production of both sulphate of ammonia and concentrated gas liquor, corresponding to a make of 35,300 million cubic feet of gas a year.

(To be continued.)

The Gaslight and Coke Company Push Business.—Following in the wake of a goodly number of suppliers of gas in different parts of the country, the Directors of the Gaslight and Coke Company are bringing before their consumers, by means of a leaflet, the important fact to them, that gas is cheaper than electricity. The leaflet is also made the vehicle for reminding them that on the 1st prox. the price of gas for private lighting will be reduced to 3s. per 1000 cubic feet. After a few general remarks, a comparison is made of the two competitive illuminants, on the basis of 4d. per Board of Trade unit and the Company's reduced price of 3s.; reckoning the unit as equivalent to 15 cubic feet of gas consumed with incandescent burners. The result is startling: Electricity, 4d.; gas, 0·6d. In plain language, the cost of gas is less than one-sixth that of electricity. This is the financial side of the question. But there is another. The electricians are fond of claiming, as some of the advantages of their illuminant, absence of smoke and heat, as well as adaptability. The compilers of the leaflet present corresponding advantages to be derived from the use of gas, especially its adaptability not only for lighting and motive power, but also for heating, cooking, and ventilation. So much for the ordinary consumer. The next point made is in regard to public lighting, for which the Company supply gas at the rate of 2s. 5d. per 1000 cubic feet. It is shown that, with self-intensifying gas-lamps, a light of about 900-candle power can be produced for a year for £18 17s. 3d.; whereas an electric arc lamp of 800 to 1000 candle power (nominal) costs £30—a difference of £11 2s. 9d. in favour of gas. Allusion is made to the fog-penetrating power of gas, and emphasis is laid on the circumstance that municipalities who supply electricity prefer gas for the public lighting.

OBITUARY.

WILLIAM CARR.

The truth of the solemn words of the Burial Service of the Church of England, which remind us that "in the midst of life we are in death," was borne in upon us with painful impressiveness yesterday morning, when the news reached us of the sudden decease last Saturday of Mr. William Carr, of Stalybridge. Mr. Carr was present at the meeting of the Manchester District Institution of Gas Engineers at Wakefield only a week previously; and, as our columns last Tuesday testified, he took his accustomed keen interest in the proceedings. His voice is now silent for ever. Mr. Carr's last days were passed in the town in which he drew his first breath, and in which not a little of his work in connection with the industry of which he was by no means an undistinguished member was done. He was born at Stalybridge in 1850, at which date his father was in the service of the Gas Company there. He entered upon his career at what would now be regarded as the prohibitive age of twelve; but, like many another man who has attained a good position in the world, he did not suffer very greatly from being thus early taken from school to practically apply in the business of life the knowledge—which in those days was probably thoroughly useful—he had gathered. After spending eleven years at Stalybridge, he obtained the position of carbonizing foreman at the Beckton Gas-Works, where he acquired valuable experience in the management of a large gas undertaking. It was doubtless the possession of this which gained for him, in 1875, the appointment of Gas Engineer and Manager to the Halifax Corporation. This position he resigned in 1888, and next year he went to South Africa, to superintend the construction of the gas-works which Mr. Thomas Newbigging had designed for Johannesburg. Things were not then as they are now in that world-renowned city; and after remaining there about three years, Mr. Carr returned to England in 1892, but in impaired health which compelled him to refrain from active work. He took up his residence in his native town, and, by a curious concatenation of circumstances, became in 1896 the Engineer and Manager of the gas-works, which since his previous association with them had passed into the hands of the Corporation. During his supervision of them he effected considerable improvement; but, unfortunately, his health had been too much shaken to enable him to throw into his work the energy which was characteristic of him, and which he was only too anxious to display. Leave of absence was granted him in the hope that rest and change of scene would be beneficial; and not long ago he accompanied his brother Isaac to the Canaries.

Mr. Carr, as his colleagues well know, was a keen debater; but he also contributed useful original matter to the literature of the gas industry. He joined the Manchester District Institution in 1875, and filled the position of President in 1880. A noteworthy contribution to its proceedings was the paper read by him at the meeting of the Institution in Manchester, under Mr. Eastwood's presidency, in November, 1883—in which year his predecessor at Stalybridge (the late Mr. Robert Hunter) was Vice-President—on "The Right of Local Authorities to Make Profit from Gas Undertakings." Mr. Carr joined the British Association of Gas Managers in 1876, and remained faithful to it as the Gas Institute. Last year he was elected on the Council. We have reason to know that he had the future position of the organization closely at heart; and he was very desirous of taking the right view of the important question of its amalgamation with the Institution. A few years after his admission, he gave his fellow-members the results of his study of gas-engines in the paper on that subject which he contributed at the meeting in Newcastle. The value of the paper, in the estimation of the Committee of the Association (as it was then), was shown by the award to its author of the first premium of £10. Another valuable contribution was on "The Rating of Gas-Works," read at the Manchester meeting in 1885, when Mr. Thomas Newbigging was President. This gained for him the second premium, which was presented at the succeeding meeting by the late Mr. Denny Lane. Two years ago, Mr. Carr gave the Institute an interesting contribution on "The Evolution of the Hydraulic Main," which led to a good discussion. In addition to these productions, Mr. Carr's literary ability was displayed in another direction calculated to be of benefit to his colleagues. The study he had made of gas-engines was considered by the Editors of "King's Treatise on Coal Gas" (Mr. T. Newbigging and the late Mr. W. T. Fewtrell, F.C.S.) to specially qualify him for writing the chapter on this subject which is contained in the third volume of that work; and he also wrote the chapter on "Cooking and Heating by Gas."

The few, possibly imperfect, notes we have been able to prepare of Mr. Carr's life-work suffice to show that he was not content to be an easy-chair member of the profession in which his lot was cast. If his views on technical and other matters were put forward in a manner which to some savoured of brusqueness, they could not be regarded otherwise than as the frank expression of his deliberately formed opinions; and though these might be in direct opposition to those held by many of his friends, we do not believe the fact was allowed to affect the cordiality of their relationship. William Carr may have made his mistakes—who has not?—but he possessed sterling qualities which, had he been physically fitted to exercise them, might have been of considerable value to the profession, in the ranks of which his comparatively early removal has made a sad gap. In Manchester and the district his loss will be keenly felt, for no gas manager was held in greater esteem. One of Mr. Carr's brothers, as our readers know, is the Gas and Water Engineer to the Widnes Corporation; and another—Mr. James Carr—is now managing the gas-works in Johannesburg.

Mr. CONYERS KIRBY, Assoc.M.Inst.C.E., Consulting Engineer to the Newport (Mon.) Corporation, for many years Borough Engineer, and Engineer to the Newport Water-Works Company, died recently, at Stow Park, Newport.

PERSONAL.

At the first monthly ballot this session for membership of the Institution of Civil Engineers, Mr. CHARLES F. FRANKS, of the South Metropolitan Gas Company, and Mr. LOUIS SIKES, of the Water Department of the Harrogate Corporation, were admitted as associate members. At a recent examination for studentship, Mr. L. E. SILCOX, son of Mr. J. H. Silcox, formerly Manager of the Pembroke Dock Gas-Works, was among those who passed.

On the occasion of the annual dinner of the employees in the Stockport Corporation Gas and Electricity Departments, on the 29th ult., opportunity was taken to present to Mr. H. E. COPP, who recently left Stockport to fill the position of Gas Engineer to the West Bromwich Corporation, a token of the respect entertained for him by his former colleagues and subordinates, and to express to him their best wishes for his future prosperity. The presentation took the form of a French drawing-room clock, with ornaments to match, all in solid brass, with a plate bearing the following inscription: "Presented to Harold E. Copp, Esq., by the Committee, Engineer, and Employees of the County Borough of Stockport Gas and Electricity Departments, on his appointment as Gas Engineer to the Corporation of West Bromwich, Nov. 29, 1901." Mr. S. Meunier, the Gas Engineer, who presided, in making the presentation, remarked upon the fact that since he had been at Stockport two of his assistants had received important appointments in other towns. On behalf of the Committee, the officials, and the men, he wished Mr. Copp every success. Mr. Copp, in acknowledging the gifts, expressed his gratitude to the donors for them, and for the kind expressions by which they were accompanied.

NOTES.

The Efficiency of Wilson Gas Producers.

Mr. J. E. Stead, F.C.S., of Middlesbrough, has reported on the working of a Wilson's power-gas generating plant, such as that described in the "JOURNAL" for Oct. 15, p. 964. This report deals with an examination of the gas taken from a main flue into which eight coal-fired Wilson producers were working. The fuel was Durham rough slack. In a perfect heat engine, 2563 thermal units would produce one indicated horse power for one hour; but a good gas-engine has a thermal efficiency of only 27 per cent. Consequently, it requires about 9500 British thermal units for every indicated horse power. According to Mr. Stead's report it is possible in ordinary working, with a set of Wilson producers, to make a gas which yields, after cooling, 75 per cent. of the original calorific value of the coal. A gas-engine of 27 per cent. thermal efficiency will thus turn 20 per cent. of the heat of the fuel into indicated horse power; and with an engine having a mechanical efficiency of 83 per cent., this means the conversion of 16·6 per cent. of the original power of the coal into brake horse power. On the other hand, if the best class of modern steam-engines use 12 lbs. of steam per indicated horse power, and are boilered to get 10 lbs. of steam per pound of high-class coal, with 90 per cent. mechanical efficiency of their own, this means that they also can show a brake horse power for about 16 per cent. of the coal heat. It is evident, however, that these are only the beginnings of the data required for a complete comparison of the two kinds of motive power. Wilson gas is stated by Mr. Stead to average 140 thermal units per cubic foot; and about 1 lb. of ordinary Durham slack will yield 1-horse power, indicated. Where the coal is rich enough in nitrogen—say, 1·4 per cent.—and not less than 50 tons per day of twenty-four hours is gasified, it is considered that it will pay to erect sulphate recovery plant. The combined plant, with three producers, then costs about £12,000. This is for a production of 4500 indicated horse power.

The Preservative Painting of Ironwork.

Mr. M. P. Wood has read an exhaustive paper before the American Society of Mechanical Engineers on the subject of the "Protection of Iron Structures from Corrosion and Rusting." The author admits that probably at the present time iron-oxide pigments are the most generally used bases of preservative paints. They result from the roasting of hematite ores for the express purpose. This roasting only expels about half of whatever may have been the original acid contents of the ores; the balance being left in. Besides, the lime and magnesia occurring with the ore are rendered caustic by the same process, and eventually combine with the water which accompanies the oil. It is the practice to add common chalk to the iron oxide, in order to neutralize the sulphur

elements naturally occuring in it. This expedient is not approved of by Mr. Wood. He remarks that, owing to the uncertainty of quality inseparable from ordinary oxide paints, many engineers have adopted a prime coating of boiled oil in preference to it. This expedient is characterized as dangerous. Mr. Wood asks, pertinently, if a coat of plain boiled oil is so good, why waste money on pigments to add to the subsequent coats? The author cites the example of the Forth Bridge as proof that it is practically impossible to prevent the rusting of such a structure by any ordinary painting. Although the bridge is always in the hands of a corps of painters, who go over it all in the course of three years, it is Mr. Wood's opinion that in the future its stability will depend quite as much upon its mass as upon the mutual strength of its connecting members. Yet every piece of this structure received two coats of boiled oil in the shops before erection, and two coats of iron oxide paint afterwards. The cleaning off of mill-scale is an essential precaution, but often neglected. It costs as much to spread a poor paint over a structure as a good one; the labour being from two to four times the price of the paint. All paints weighing the same have about the same covering power, if equally brushed out; but iron oxide hides corrosion and bad work more easily than anything else. The nearer any coating approaches to an enamel or a varnish, the better it is. Mr. Wood thinks that the coming protective coating for iron will be a fine varnish, with a carbon or graphite pigment. But it will not be imperishable in exposed situations; and it will not be cheap. Nothing, however, can be too good for structures of really first-rate importance.

COMMUNICATED ARTICLE.

THE AUDITING OF GAS COMPANIES' ACCOUNTS.

A Reply to Some Criticisms.

By F. G. Newton.

(*Concluded from p.* 1378.)

The question of what should be meant by an auditor's certificate, to the effect that he has "examined the books and accounts" of a company, has been the subject of a pronouncement from the Bench, that leaves no room for doubt as to whether it is the duty of the auditor to take all possible and reasonable steps to assure himself that such books and accounts are compiled honestly, and that they accord with the facts. The judgment to which I refer, is that of Lord Justice Lindley in the well-known case *In re the London and General Bank* (1895, 2 Ch., 683). His Lordship, speaking of an auditor's duty to the shareholders, therein said: "His business is to ascertain and state the true financial position of the company at the time of the audit, and his duty is confined to that [as distinct from the question of whether the business is being conducted profitably or not]. But then comes the question, how is he to ascertain that position? The answer is, by examining the books of the company. But he does not discharge his duty by doing this without inquiry, and without taking any trouble to see that the books themselves show the company's true position. He must take reasonable care to ascertain that they do so. Unless he does this, his audit would be worse than an idle farce."

The Companies Act, 1900 (section 23), expressly declares that the auditors of a company in their report shall certify "whether, in their opinion, the balance-sheet referred to in the report is properly drawn up so as to exhibit a true and correct view of the state of the company's affairs as shown by the books of the company;" and eminent Counsel have stated, in an "opinion" obtained by the Institute of Chartered Accountants, that the words "as shown by the books of the company" do not limit the auditors' duties to a comparison of the figures, but must be construed in the sense of Lord Justice Lindley's judgment as just quoted. Counsel also state that, in their opinion, the words "books of the company," in section 23 (which gives to the auditors a right of access at all times to the books and accounts and vouchers of the company), mean "all the books—not merely the books of account of the company." The words, therefore, include the minute books and letter books.

When, therefore, "A Shareholder" coolly sweeps on one side matters that have a very definite bearing upon the question of whether the balance-sheet exhibits a true and correct view of the state of the company's affairs, as being "beyond the scope of an auditor," and suggests that no reasonable person (a "reasonable," like an "orthodox," person being one who agrees with the speaker) could attach to the auditor's certificate more value than can be attached to an examination of the books and accounts which does not include an inquiry into these matters, he simply shows that he has not gone beyond his own ideas for information. He speaks of such matters as the allocation of expenditure to capital or revenue, depreciation of plant, and other "financial questions" as being beyond the scope of an auditor. Yet, unless the auditor has satisfied himself upon such points, how is he conscientiously to sign a balance-sheet as being "correct"—bearing in mind what the law says that such a statement implies?

"When once the directors have been satisfied that an account is payable, no further advantage can follow" from the auditor inquiring into it! He is to "examine the books" with vouchers for paid accounts without taking steps to ascertain whether those accounts were rightly payable. Such is "A Shareholder's" idea of auditing. Unfortunately, it is also the idea entertained by some auditors, whom I am desirous of arousing to a proper sense of duty. But "A Shareholder" says to them, in effect: "Don't you trouble about those matters. We, the shareholders, have appointed directors; we are quite sure that they always closely investigate every item of expenditure that comes before them, and that if they think things are all right, they are all right; and we are satisfied that our officers are honest, and there is no need for you to worry."

Then, what I want to know is, Why on earth appoint auditors? What good are they expected to do? What does "A Shareholder" pay them for? "To render valuable assistance with regard to the disposal of the balance of net revenue?" The fact is, "A Shareholder," by his failure to understand the very *raison d'être* of auditors—to act as the guardians of shareholders against fraud or misrepresentation on the part of the directors and officials—has put himself to the trouble of writing a great deal which really demonstrates little but that failure.

The question of whether directors, before signing cheques, inspect the vouchers—not by glancing at, but by carefully looking into, them—and have before them the quotations or tenders relating to those accounts, and whether it is "the usual practice" of directors "to make sure of the correctness of any particular account before paying it," has, of course, no bearing upon the duty of the auditor. (If a director and the secretary were in collusion with a coalowner to pay him 1s. per ton above contract price, or if a director, trading under another name, were to act in collusion with the officials in order to receive more than the quoted prices for goods, what defence would an auditor have who passed such accounts without comparing them with the contracts or the minute books?) But it is perhaps as well, since "A Shareholder" says that "the presumption is" that directors do so exhaustively examine the items of expenditure, to remark that my information does not confirm that assumption. In fact, many directors, I believe, rely upon the auditor, who, we are told, is to rely upon them!

In reference to the audit of wages paid, "A Shareholder" several times speaks as though I had proposed to "open up independent communication with the workmen." I never suggested, nor thought of suggesting, any such policy—expressly speaking of the difficulties which might be found to lie in the way of such a plan were any auditor to think of adopting it. The paragraph in which I dealt with the question of the wages account shows that I was fully cognizant of the practical impossibility of efficiently auditing that account. The best that can be done is to make sure that the calculating and paying of the wages is not confined to one individual; that the principal rates of pay are correct; that the sheets are properly cast, and are duly certified by the works manager—who must not have also compiled them; and that the cash entries correspond with the sheets.

"A Shareholder" is of opinion that an auditor could do no good by attempting to check stocks, and adds: "If it is considered that a second independent check of the stocks and working results is required, the only efficient method is to call in a second expert. We do not think of employing an engineer to audit the books; it is equally absurd to send an accountant to go into technical details." He also says: "It would be possible to make up a heap of coal in such a manner that the mere cubing or measuring up of its outside dimensions would give an erroneous result; and a manager who did not hesitate to enter fictitious names and payments in a wages-book, would be quite capable of making arrangements that would evade detection."

To take the last point first, there is this to be remarked. The making of such arrangements would involve much more extensive collusion than would the gradual over-statement of the stock in the books, which might in fact involve none; and it should be a prime object of every auditor to so conduct his examination, and to require the books to be so certified by the staff, as to make collusion necessary for the perpetration of fraud. Further, if an auditor has taken all reasonable steps to check the stocks, his duty has been fulfilled, even if he has been criminally deceived by such arrangements as reasonable steps could not discover. (And a manager might be equal to "overestimating" his stock—which might be excused as an error of judgment—who would not run the risk involved in building up a bogus stock for the auditor to measure.) But if he simply accepts the word of the engineer, would a Court consider that he had taken all reasonable steps to verify the assets?

As to the employment of an expert, it may well be pointed out again that if an auditor does not feel himself competent to do that which, in his opinion, should be done, he has always section 108 of the Companies Clauses Consolidation Act to fall back upon; and can call in an expert (accountant, engineer, valuer, or any other) to assist him, at the expense of the company. There is, however, a much more simple course open to any auditor who does not feel qualified to examine stocks, or to check the apportionment of expenditure between capital and revenue, or to verify the wages bill, or to conduct any other of the enquiries necessary to the adequate auditing of a balance-sheet, and that is: To set out the fact clearly in his certificate—stating that in regard to (say) the stocks of coal, residuals, stores and sundries, valued in the balance sheet at so much, he has relied upon the certificate of the engineer, storekeeper, or other person. It would then be for the shareholders to say whether such an audit was all they required

—whether they were satisfied with the unverified statement of their officers. If so, well and good so far as the auditor's responsibility is concerned, though his importance would be thereby greatly diminished. If not, he must either fall back upon the employment of experts, or make way for someone willing and able to fulfil more completely the function of auditor.

The whole purpose of my original article was, indeed, to show what must be done by an auditor before he can honestly sign his name to a balance-sheet with "examined and found correct" above his signature. If any part of the course of action planned out—limited, be it again said, to a "test" audit, not an examination of every item—be deemed either impracticable or too expensive, then the auditor's certificate must definitely state that such work has not been done. To continue to sign a certificate which one person imagines to imply an exhaustive and reliable audit, while another is not sure what it implies, and yet another feels sure it means little or nothing, is neither honest nor wise.

Mr. Helps, whose letter (that I have left unanswered so long) shows that he takes an informed interest in the subject, thinks I am "a little too theoretical." That is not, I think, a serious matter, if, as he agrees, the theory is correct. What we want is intelligent practice founded upon sound theory, instead of what we often get—casual methods unsupported by any definite, intelligible theory. What I have here already written—and, indeed, my original article—will show that I am in agreement with Mr. Helps as to auditing at its best not providing complete protection for the shareholders against the fraud of their servants. The point is that so many audits, as now conducted, afford none, and that shareholders are not aware of the fact.

Mr. Helps will have seen that I agree that, if an auditor cannot cover all the ground necessary to an efficient audit, his certificate should specify the omissions. This would, as he says, serve to make more evident the responsibilities devolving upon directors and managers. "Good auditing cannot make up for indifferent or untrustworthy managers" is perfectly true; partly, of course, because auditors are not concerned with management—a fact that perhaps needs emphasizing. Accounts may be correct, while the management is far from faultless.

The main point of difference between Mr. Helps and myself arose, if he will excuse my saying so, through an ambiguity in his first letter. He suggested that auditors should remain "in their present positions," and that managers should take more interest in the accountant's side of their business. I understood by "auditors remaining in their present position," continuing to do as little, and that as unintelligently, as hitherto. Mr. Helps says he meant doing what they are supposed to do—a very different affair, with which I should be content, provided the duties they fulfilled were those that Mr. Justice Lindley "supposes" them to do, and not what "A Shareholder" apparently conceives to be their duty. Only I must repeat that no acceptance ofresponsibility by a manager can relieve auditors of theirs, unless the arrangement is known to, and sanctioned by, the shareholders.

Let us hope that this correspondence may induce a few more auditors to consider what they are supposed to do, and to do it; and that it may inform some shareholders as to the necessity for, and the dearth of, efficient auditing. Should it further serve to remind boards of directors and committees that a sound and thorough method of keeping books of account, and also books of record, is worth its cost and much more, many managers will, I am sure, be very thankful.

At the close of the adjourned discussion, at the meeting of the Institution of Civil Engineers this evening, on a communication on "Train Resistance," Mr. Bryan Donkin will read a paper on "Motive Power from Blast-Furnace Gases."

Probate has been granted of the will of the late Alderman Lennard, of Leicester, whose death on the 14th of September last was recorded in the "JOURNAL" at the time. He left estate valued at £46,696 gross, including £22,651 net personalty.

The will of Mr. Augustus William Gadesden, of Ewell Castle, Surrey, who was for some years Chairman of the East London Water-Works Company, and who died on the 15th of August last, as recorded in the "JOURNAL" at the time, has been proved. The value of the estate is sworn at £305,823.

Re-arrangements of offices in the Engineering Department of the Gaslight and Coke Company have been made. Mr. Trewby's position of "Consulting and Constructing Engineer" to the Company has been altered to that of "Chief Engineer." Mr. Goulden has been appointed as Assistant-Engineer, and so is removed from Beckton to Westminster. Mr. Iago (who has been Engineer of the Fulham Station for many years) will succeed Mr. Goulden at Beckton. Mr. Goulden, it will be remembered, was appointed Engineer of the Beckton works on the death of Mr. John Methven in 1898.

The Gas and Water Committee of the Carlisle Corporation have adopted a scheme of reorganization of the management of the gas and water works of the city. It provides for the appointment of Mr. H. C. Marks, the present City Surveyor, to the post of Water Engineer, and of a Gas Manager (who will be advertised for) at a salary of £350 per annum, to devote his whole time to the duties, and to have a knowledge of the manufacture of carburetted water gas. Mr. Clarke, who has hitherto been Chief Accountant at the gas office will be appointed Gas and Water Accountant and Deputy City Treasurer, at an increased salary.

TECHNICAL RECORD.

HECKMONDWIKE INCLINED RETORTS AND COAL AND COKE PLANT.

That the inclined retort system can be applied with advantage in the case of gas-works of modest output has been proved by the infallible test of experience; but though there are works of comparative size which may equal, we know of none which will excel, in completeness, the installation of inclines and coal and coke handling plant which has become the feature of the Heckmondwike Gas Company's works. Here we have a works carbonizing about 10,250 tons of coal per anuum; and, in the course of a short time, every pound of that coal will enter the works and the bulk of it will take its departure again in the form of gas and coke without being touched by hand—the whole of the labour attached to the actual work of carbonizing and coke removal being accomplished by less men in the twenty-four hours than one has fingers upon his hands. The circumstances of the works compel the use of the phrase "in a short time," because at the moment the new retort-house, which stands on the site of the old, shelters three beds of the new inclines and the surviving representatives of the old horizontals, which had, while the work of reconstruction was going on, to perform the duty of keeping the townsfolk supplied with their gas requirements. But the coal breaking and elevating machinery is there; and the coke-conveyor to the extent of the three beds and the coke distributing plant are in position, and are duly and daily now performing their allotted tasks. The inclined installation, with its perfecting accompaniments, is entirely due to the initiative of the Company's Engineer and Secretary (Mr. A. F. Goodson); and it follows that he has faith that, by the aid of his new possession, he will be able to produce for those he serves adequate compensating financial results for the outlay incurred. The acceptance by the Board of his advice to commit such a revolution in their manufacturing operations is a visible and conspicuous proof of their confidence in his judgment. The work has been carried out, without subcontracting in any particular, from the reconstruction of the building to the installation of the complete plant, by Messrs. Robert Dempster and Sons, Limited, of Elland; and the manner in which they have so far finished their contract—both in workmanship and in resulting irreproachable operation of the plant—reflects upon them the highest credit.

The installation includes several features of interest; and they, and the free and easy movement of the whole operations, raise in one's mind considerations affecting polemic points associated with this advancing system of carbonizing. The hoppers, the chargers, the uniformity of the egress of the spent charges unaided, and the coke-conveyor all touch upon recent controversial matters; but we are not going, in describing the plant and writing of what we have seen of its action, to range ourselves on either side in the disputation, but may give place to another's views on two or three of these points. However, it is not astonishing that the success which has attended their latest example of inclined work should have induced Messrs. Dempster and Sons to obtain the permission of the Chairman (Mr. Joseph Stead) and the Directors of the Heckmondwike Gas Company to show the plant to the gas engineers of the Manchester district; and a large number accepted the invitation to be present at an inspection last Friday. Mr. Stead and his colleagues were courteous to the extreme in welcoming the visitors; and Mr. Goodson was equally pleased in receiving his brethren, and in actively pointing out the interesting features of his scheme, which has modernized and reorganized the Company's manufacturing department. As the responsible engineer, he is, of course, confident. Mr. Stead, on the other hand, as one of the trustees of the shareholders' interests, as the astute business man that he is, who wants to see the results of the investment of his capital before decisively declaring that he has acted wisely in making that investment, spoke with caution to his visitors on Friday. He feels confidence as to the advantages to be derived from the new works; but he refuses to definitely commit himself, from the financial point of view, until he has before him the actual results of a period's working. As he told the visitors, the concern has been a prosperous one, and the statutory dividend has been paid for the past thirty years or more; and we, on our part, entertain not a shadow of doubt that under the new order of things, that happy condition will be continued. Mr. Stead fully recognizes that the laborious portion of carbonizing work has departed for aye from Heckmondwike, and that the lives of the men employed will be rendered the more cheerful by the change. He also believes that the Directors will find that the manner in which the work has been executed will justify their employment of Messrs. Dempster and Sons to carry it out. On this point, Mr. Stead must have been gratified in hearing the satisfaction which Mr. W. Buckland, of Chesterfield, expressed with the inclined retort installation by the firm at the works under his own charge.

Now we will deal more particularly with the installation. There is little which need be said about the house itself. It is, as such buildings should be, substantial and bold in design; is 81 ft. 6 in. long, 60 ft. broad, and 50 ft. high to the roof; and stands in such a position that, by its prominence, the stranger on

leaving the railway station is able to readily locate the works. The roof of the old house has been brought into the service of the new. Ultimately the building will contain six settings of eight retorts, tapering from 20 in. by 16 in. at the charging end, and 23 in. by 16 in. at the discharging end, and of the Sydenham-cum-Edinburgh section. In order to maintain gas production, only three of the settings could be erected at the start; but now that these have been proved during the past six or seven weeks, the demolition of the remaining old settings and the raising of the new will be immediately proceeded with. A complimentary word may be appropriately inserted here. The urgency of the work, and the peculiar conditions under which it was to be conducted, demanded special care and deliberate action in preparation and execution. The contract was only entered into in March last; and the completion of the work to this stage—without interfering with the gas supply and without any accident—in six months or thereabouts is an achievement with which both the Engineer and the Contractors may plume themselves. The settings are heated on Mr. W. R. Chester's regenerator system; and the heats are certainly all that can be desired.

The description of the plant may conveniently follow the manufacturing process. As received, the coal is shot into a hopper partially forming the roof to an underground cellar, in the floor of which is situated the coal-breaker. Immediately under the hopper outlet is a large travelling tray, which, on its outward move, takes with it a supply of coal from the hopper, which supply its backward move precipitates into the breaker. This is an ingenious and positive method of feeding; but it is not new, although we believe it has not been extensively adopted—anyway in this country. The bottom of the hopper is open to the travelling feeder; but, by the use of the latter, it is evident that it is quite impossible to overfeed the elevator. The hopper being filled, the work goes on, when once commenced, automatically and without attention. The machinery is started by the works foreman, and stopped by him—the travelling feeder being put into action simply by operating a lever. But the feed to the elevator is cut off before the steam-engine driving the plant is stopped, and by this means the elevator is completely emptied, so that, when the engine is again started, the work begins with an empty elevator. The arrangement is certainly a very simple one. The coal-breaker and elevator are capable of dealing with 20 to 25 tons an hour.

Following the coal, we come to the continuous storage hoppers above the benches; and these we learn are constructed to contain a 36 hours' supply. When the installation is complete, although there will be six retort-settings, the hoppers will only be over five. Each hopper has two outlets, which are operated by levers; but none of them are exactly central with any tier of retorts. The retorts are charged by means of a set of three travelling measuring chambers and shoots—one for each vertical tier of retorts. The chargers are propelled by a chain wheel and gearing. Although, of course, there is a little more labour required from the men (and one man is sufficient to deal with the charging work here) to move both measuring chamber and shoot, instead of a shoot only, the difference is but small. The chargers and measuring chambers answer readily and easily to the slightest pull of the chain on the part of the man. So that in this installation, the fact that the measuring chambers and chargers are combined makes absolutely no difference to the cost of labour on the charging-floor. There being a separate machine for each row of retorts, they are adapted to secure an even drop to each line; and of the thirty or so engineers who examined the spent charges on Friday, and saw the re-charging of the retorts, not one will, we think, question our assertion as to the evenness of the charges.

Now on one of the foregoing points, as on others in connection with this inclined system, it is interesting to get the opinions of men who are constantly engaged in the actual construction of apparatus of this character. They may have their own particular fads, and their own specialities to dispose of; but if we obtain an insight into their views, and the considerations which weigh with them in connection with their work as producers of plant, gas engineers are easily able to pick out for themselves that which is the most practicable and sound from the common-sense standpoint. During the inspection at Heckmondwike, we took an opportunity of gathering in conversation the views on this and that portion of the plant of Mr. J. W. Broadhead (of Messrs. R. Dempster and Sons); and we will introduce them as we proceed. On this question of the charging arrangements, he points out that, as a man must be employed on the charging-floor, so far as labour is concerned, no saving would be achieved by having a measuring chamber over each retort—in fact, he contends that the system as at Heckmondwike must of necessity be much cheaper than certain others. And here he is in harmony with Mr. S. Y. Shoubridge, save on the one point that Mr. Broadhead advocates a modified form of continuous hopper, without the fixed line of measuring chambers, instead of centralized hoppers. At Heckmondwike, as already mentioned, the continuous hopper is only arranged over five of the six beds; and he maintains that, if the hoppers were made large enough to hold a sufficient number of hours' storage (which would, of course, be dependent upon the height of the building), they need not extend over more than three or four beds, against the system of continuous hoppers over every setting. Then, he points out that three measuring chambers on the chargers at Heckmondwike suffice, as against, on the other system, three measuring chambers for each bed, or eighteen for the complete installation. The saving, he says, in first cost is obvious; and the slight extra labour involved on the man on the charging-floor cannot possibly be represented in £ *s. d.* The man is and must be there; he has to be paid; and he is far from being burdened with work. Speaking of the attendants required for this installation, it may be stated here that it was noticed during the visit that, in addition to the charging-floor man, there is one on the discharging-floor, and another to attend to the furnaces. The latter assists the drawing-floor man when he is feeding the furnaces; and he also starts the coke plant steam-engine. As mentioned, the works foreman controls the coal-plant engine.

The charges are 6 to 7 cwt.; and they consist of local and South Yorkshire coal—the proportion being respectively about 70 to 30 per cent. The duration of the charges is five or six hours; and the inspection on Friday proved their thorough carbonization—the heats of the retorts being of that character which gladdens the heart of the gas manager. On the release of the stoppers, the charges really tumbled out of the retorts. There is a slight delay in the complete clearance of the bottom retorts—not due to the retort itself, but to the fact that the coke cannot all get out until the conveyor moves off with part of the mass; and with the progress of the conveyor, the remainder of the charge tails after that which has already passed along.

The coke-conveyor is one of the specially interesting features of this installation; and in its design, the main aim of the makers has been to remove the operating parts from the wearing influence of the coke. As Mr. R. G. Shadbolt put it, in one of his characteristic and happy little speeches in the course of the visit, this is not a push-plate conveyor, nor is it a carrier, but the cross-pieces are in the form of a rake which gently induces the larger pieces of coke to pass along, and the smaller pieces which escape are taken forward by the larger pieces resting against the succeeding rakes. "I believe," Mr. Shadbolt added, "that the makers have achieved their object with a minimum of friction." But more in the way of description anon. We also had a little talk with Mr. Broadhead on the question of conveyors; and we learned that his opinion is that all forms of conveyor whose operating parts are submitted to the grinding action of the coke are absolutely wrong. For instance, he says that in the type where the chain runs in the middle of the trough, and the coke drops on to the chain, there must unavoidably be considerable wearing of the pins and the rubbers which run along the trough. Then in regard to the carrier type, he points out that the rollers and pins run in water charged with coke and gritty-matter; and, consequently, the chain might just as well be on the top, and be fully exposed to the hot coke. However, these are the views which he and his firm hold; and so in their new coke-conveyor (which is, of course, patented) they have kept the main wearing parts outside the trough in which the rakes work, where they will not be subjected to anything more than normal wear. The rakes to which we have referred are attached on either side to chains; and these chains are outside, and altogether free from, the trough—in fact, they can be removed any reasonable distance from the trough which an engineer's fancy may prescribe. The chain employed is a parallel one; there are no projections—in fact, it is square in section. The chain can be run over double-flanged rollers; and these rollers keep it in position, and also prevents it coming in contact with the sides of the trough. Thus there can be no wear or tear by the chains catching the trough sides or bottom—in short, Mr. Broadhead claims that the use of the chains in the manner described results in the minimum frictional wear and tear. The example of the conveyor as used at Heckmondwike works smoothly and noiselessly.

The quenching of hot coke as it falls from the retorts is a problem that has not yet been altogether satisfactorily solved; and on this point we gathered that Mr. Broadhead's experience is that, if a trough is flooded with water, say 6 or even 9 inches deep, the first charge of hot coke that falls into it will remove, or carry in front of it, sufficient water to make the remainder ineffectual for dealing with the succeeding spent charges, no matter whether the conveyor be of the carrier or push-plate type. This being so, he contends that an empty trough is as good as one filled with water. In the Heckmondwike installation, Messrs. Dempster and Sons have applied sprinklers, which are fixed a little distance above the trough, are of the full width of the trough, and are operated by an arm fixed to the buckstays. Certainly, the sprinklers were accomplishing their purpose in an admirable manner during Friday's inspection. Scattering the water over a large surface of the hot coke seems a more rational method of quenching than the single stream of water (as in the case of some conveyors we have seen) falling in a central line, without distribution, along the length of the hot coke.

On another point, no one will disagree with Mr. Broadhead that the less knocking about coke receives, the less will be the quantity of breeze made. Therefore, he has come to the conclusion that, to secure for the coke an easy journey to its destination, the conveyer proper should be continued outside the retort-house in a straight line, and then inclined, so as to do away with elevators. Even where space does not allow of such an arrangement, he thinks that the best way to elevate the coke to the height required for storage purposes is not by allowing an elevator to pick the coke up out of an elevator boot. At Heckmondwike, a tray elevator is employed; and, the trays being continuous, the possibility of any coke dropping down between them is thus obviated. The coke is fed on to the uptake of the elevator; and the first discharge is into a 10-ton storage hopper, under which

carts can back, and be loaded by simply pulling a lever. In the event of the hopper being full, by simply pulling another lever the coke is permitted to pass on to a Zimmer oscillating conveyor (supported on a gantry), which, however, does not convey it in the strict sense of the word, but simply jerks it along, and drops it through openings in its length of some 80 feet, over the storage ground. Most engineers will regard the vibrating action of this type of conveyor as a fatal objection to it. We can hardly imagine, for instance, that its use will be espoused by engineers for inclined retort-houses in which the maintenance of the stability of the benches is a *sine quâ non* to continuous good working; and anything in which lurks a possible assailant of that stability will not find place inside many, if any, houses in this country. Simple it is; and the wearing parts are few. But that it is the best thing in the market for the transmission to any great distance of such a material as coke, or for use inside an inclined retort-house, we fail at present to see. However, we may be mistaken in this view, and should like information from some quarter in which the conveyor has had an extended application to this particular service. We have digressed a bit; but we can end here our reference to the coke plant by mentioning that, under the length of oscillating conveyor at Heckmondwike, stacking-shoots have been arranged, so as to reduce to a minimum the drop of the coke from the conveyor to the yard-level. The coke found deposited in the yard, at the time of the inspection, presented a large appearance, and, so far as could be seen, did not contain an abnormal proportion of breeze.

From what we have written concerning this new carbonizing and coal and coke handling plant at Heckmondwike works, it will be remarked that the installation contains some distinguishing features, and features which will claim attention. We venture to say that not one among those who spent the afternoon on Friday at these gas-works regretted the time expended in making the visit. To the congratulations which were then tendered to the Directors and Engineer upon their enterprise in advancing to one of the highest forms of present-day methods of dealing with the staple raw material and one of the products of gas manufacture, we may sincerely add ours, together with the hope that, under the new conditions, the concern may attain to even greater prosperity than has been its reward in the past.

AMERICAN GASLIGHT ASSOCIATION.

Annual Meeting at Boston.

(*Continued from p.* 1459)

Mr. W. E. M'Kay, of Boston, read a paper on "Tar and Water from Water Gas." A large number of papers dealing with the formation, separation, distillation, and use of tar for coal, oil, and water gas processes had been read before various American Gas Associations; and a list of these was submitted in an appendix. He might be asked why the Committee on Research retained the subject on their permanent list. Was there more tar made; did it improve in value; had its production become a nuisance; or were a larger number of companies learning that tar was an important residual? In answer to these questions, extracts from the "American Gaslight Journal," extending over the last ten years, were quoted; and a table showing the product of coal gas, oil gas, and water gas in the State of Massachusetts from 1887 to 1900 was given. During that period, the make of coal gas has fallen from 2739 million cubic feet to 2002 millions; the make of water gas has increased from 28 to 2880 millions; and the proportion of oil gas was inconsiderable—being only 10 to 14 millions per annum. In 1887, 99 per cent. of the total was made from coal; in 1900, only 41 per cent. During the 14 years, the total make of gas had risen from 2778 million cubic feet to 4891 millions. The quantity of oils used as enrichers in connection with coal gas, showed a considerable decrease. In 1887, more than 1,000,000 gallons of naphtha, 88,000 gallons of gas oil, and 42,000 gallons of crude oil were consumed; but in 1900, only 467,000 gallons of gas oil and 70,000 gallons of naphtha were employed. The enriching oils used in connection with water gas were 171,000 gallons of naphtha in 1887, and 5,895,000 gallons of naphtha and 7,134,000 gallons of gas oil in 1900. Another table showed the quantity of coal consumed, make per ton, and oil consumed per ton. A large quantity of the tar produced was used as fuel, or disposed of otherwise than by selling; but the statistics of the income from the sales of residuals showed that, whereas in 1887 tar only contributed 18 per cent. of the income, in 1900 it made up 32 per cent. under that head. All these statistics were exhibited in full detail, and also a number of extracts on the uses of oil tar, the percentage made, and the composition of tar from various parts of the apparatus. As to the quantity of tar produced, he had found that, with a double superheater Lowe apparatus, crude oil averaged 13·5 per cent., gas oil 15·6 per cent., and naphtha 2·6 per cent. This referred to tar almost free from water. The system used for separating the tar from the gas and the water from the tar was simple. At the wash-box, the lightest possible seal was carried; and the supply for the wash-box was drawn from the reservoir for the liquids flowing from the condensers and scrubbers. The level of the suction-pipe was so adjusted as to return mostly water to the wash-box; the tar emulsion flowing on slowly to other sections of the tar-wells. The liquid entered the wash-box at about 165° Fahr., and left at about 175°; returning to the same tank from which it was drawn. The gas leaving the wash-box was saturated with aqueous and tarry vapours at about 189°, and was subsequently water cooled in tubular condensers, and by air in dry scrubbers, and met no fresh supply of water till it reached the station meter. It entered the purifiers at about 60°; and the tar, &c., carried mechanically by the gas were absorbed by shavings in the usual way. No auxiliary heat was used in the tar-wells, where the onward flow was only equal to the tar made *plus* the excess of steam used in the Lowe apparatus; and so the total flow was 1½ to 3 gallons per 1000 cubic feet of gas made. All this surplus water and tar was pumped once each day into a tank, and separated by heat from a steam-coil fixed near the bottom. The usual consumption of heat for this purpose was equivalent to ¼ lb. of coal per 1000 cubic feet of gas made; but frequently as much as ½ lb. was required. They had often handled oil tar from the Wilkinson apparatus, and separated an emulsion of 66 per cent. of water at a cost of less than ¼d. per gallon of tar recovered. In the tank, the liquids were heated to 212° for some time, then allowed to cool to 150°. The tar was run direct to the store wells; but the water was first passed through a filter, packed with small, screened generator cleanings, to remove traces of tar. A ton of cleanings would clear the overflow from 10 million cubic feet of gas, and then be a good boiler fuel. The water carried off a small portion of light ash and lamp-black from the screenings; and these components gave subsequent trouble—being convenient vehicles for naphthalene deposits. The presence of a small amount of free carbon was presumably a cause of retarding the separation of the emulsion. In the coal-gas apparatus, any flocculent carbon present in the gas was absorbed by the tar before the scrubber was reached. In the water gas apparatus, however, hot gas was forced through cool water; and after this bath, there was some free carbon that could never be blended with the tar. Some of the oil tars consisted almost entirely of benzol and napthalene; but even with low heats, the use of such solutions in the Lowe apparatus led to the formation of lamp-black, and very little addition to the illuminating value of the gas. The presence of the lamp-black delayed, or even totally prevented, the separation of the tar and water. The best results he had obtained from a tank having a capacity of 27,000 gallons, fitted with a steam-coil comprising 380 feet run of 1-inch pipe, and steam at 110 lbs. pressure, was the separation of 3500 gallons of tar per day. At the wash-box, he had found that a gas at 192° would take up nearly 11 gallons of water and tar per 1000 cubic feet. In estimating the value of oil as an enricher, credit should be given for the proportion of tar recovered. Thus, if 5 gallons of oil per 1000 cubic feet gave 30-candle gas, and the residual tar was 1 gallon, the net efficiency was $30 \div (5 - 1) = 7{\cdot}5$ candles per gallon of oil.

Discussion being invited, Mr. A. S. Miller said that the paper was a complete and exhaustive treatise on the subject. Mr. Morris separated on a system almost opposite to that described in the paper. He used three tanks, 26 feet diameter and 8 feet deep, each having a division-plate across the middle carried to within 2 ft. 6 in. of the bottom. The fluids from the wash-boxes and tar-drains flowed in series through the tanks; and a portion of the tar was returned from the first tank to the wash-box, which had the effect of reducing the rate of flow through the other two. The temperature of the emulsion was kept at about 100°; and results similar to those described were obtained. He failed to see why the emulsion should first be passed through a series of wells, and then the separator; and also why live steam at 110 lbs. pressure should be used when there was exhaust steam to be had for nothing. The cost of separation was alluded to; but by using exhaust steam, he was able, on an average of three years working, to reduce the cost of separation to $\frac{1}{16}$d. per gallon. He asked if the author had ever been troubled with high back pressure due to foaming of the emulsion in the wash-box; and, if so, what means were adopted to get rid of it. Sometimes he found it necessary to steam out the boxes and start with fresh water, and sometimes they ran for weeks without trouble. He would also like to know if the separation of 3500 gallons of clear tar per day was the result of constant work over several successive days, or of intermittent working. He would also ask how the author arrived at the specific heat of the vapours. The best enriching efficiency he had obtained was 7·5 candles per gallon of oil, which was in July; and he would be glad to know if the author's figure was obtained at that period of the year. Mr. Norris said that the particulars given of the composition of water-gas tar showed that it was not uniform, but varied greatly in quality, according to the method of working; and he commented on the proportions of free carbon, hard pitch, and naphthalene. Mr. Curtis said that he found water-gas tar as good, and as readily saleable to the distillers, as coal-gas tar. Mr. Klump treated his gas in dry scrubbers and tubular condensers. His tar contained 40 per cent. of pitch and 15 per cent. of naphthalene. Mr. Forstall thought the statement that gas at 192° would take up 11 gallons of tar and water per 1000 cubic feet was based on the assumption that it was dry, and pointed out that the gas from the Lowe apparatus contained a fairly large excess of steam. In figuring the net efficiency of oil, the difference between the specific gravity of the oil and that of the resulting tar should not be overlooked.

Mr. M'Kay, in reply, said that, to a certain extent, his wells were now idle. The successful use of the regurgitation system rendered them excessive, so they were designed to deal with a heavy flow of water. He used high-pressure steam as being the

more economical. He found that, the higher the pressure, the greater the efficiency. Exhaust steam at low pressure was more convenient in working, apart from cost, if the temperature could be properly maintained by its use. No foaming had occurred in the wash-box of the Lowe apparatus; but in the Flannery set, a deposit of carbon accumulated on the lower edge of the dip pipe, and caused trouble. The 3500 gallons efficiency was maintained for about a fortnight; and he also found that the best enriching results were obtained in summer. The proportions of lamp-black and napthalene, of course, varied greatly according to the temperatures worked. In his estimate, he had considered and allowed for the excess of steam in the gas from the Lowe apparatus. If the process of separation was watched as the temperature rose, the first difficulty came with the driving off of the absorbed gas, as with coal tar; then, at intervals, other distillates were given off. He steamed for seven hours, turning on at night and shutting off in the morning, as a convenient method of working, and found that, with 60 lbs. pressure of steam, the cost of fuel was double that of 110 lbs. pressure, in order to get proper separation. The author also, at considerable length, explained details of his various tests and experiments.

Mr. E. H. Earnshaw, of Philadelphia, read a paper entitled "Further Notes on Retort-House Practice," which was given in the "JOURNAL," for last week, p. 1460.

Discussion being invited, Mr. W. A. Miller said that, while approving of many of the suggestions offered in the paper, he could not understand why it should be advised to force the fire to a white heat just after the brickwork had become thoroughly dry, or for that matter at any other time. The labour account on the operating floor struck him as larger than necessary, as in his practice the men averaged 76 retorts each in a twelve-hour shift; whereas the author's men only averaged 36 in an eight-hour shift. His men averaged cleaning nineteen bridge and stand pipes, filling five furnaces, and sweeping the floor in front of five benches, against an average of six pipes and two furnaces mentioned in the paper. The amount of attention given to the dip-pipes seemed to indicate continual stoppages, only prevented from becoming chronic by the constant use of pipe-clearing tools. He did not agree that six-hour charges necessarily gave a lower candle gas than four-hour charges. Mr. Greenough said it was not difficult to get a yield of 11,500 cubic feet per mouthpiece per day; but having regard to the quality of tar produced, he questioned the wisdom of running such high temperatures, and there was something to be said in favour of longer charges. He found it was quite practicable to work a yield of 10,000 cubic feet per mouthpiece without removing the lid more than once in the charge. Slicing and poking the coal was unnecessary, if proper coal was used. He did not think it good practice to use coal that could not be worked off in four hours without being stirred up. With regard to scrubbing, it was a good plan to keep 3 per cent. of the retorts burning out all the time. Mr. Beal, after careful experiments, fixed upon full-depth settings with outside generators some four years ago, and had kept to that system ever since. He had little or no difficulty with thick tar or stopped pipes, though he averaged 11,410 cubic feet per retort and 39,170 cubic feet per man. This included bringing in coal and loading coke. He was able to keep the benches in work for three years or more continuously, and thought that, with care in the selection of design and material and careful working, as good results could be obtained without machinery as with it. Mr. Carroll Miller also observed that the labour account was high, which seemed to be due to continual clearing of pipes. He used regenerator benches, and could run thirty days without doing more than could be done at the mouthpiece with an auger. Mr. Russell said that keeping the retorts as full of coal as possible would do away with most of the trouble from lamp-black; and with a properly designed main and tar outlet, there need be no trouble from pitch Mr. A. E. Forstall, in alluding to the proper regulation of the damper, instanced the peculiar characteristic appearance in the furnace above the fuel, which was easily recognized by experienced men. In cleaning stand-pipes, it was necessary that they should be properly cleansed to within ¼ inch of full bore; and if this was done every scurfing time, and the auger was used at each charge, there should be no necessity for augering them from the top every day. The basket bore, as described, was a great improvement, having a tension piece to keep it full bore. This was so important that he recommended testing the augers daily with a standard steel ring accurately made to the size of the ascension pipes. He agreed that it was better to keep a fixed percentage of the retorts on cleaning continuously. Some years ago, a German gas engineer made exhaustive experiments on the proper relation between the cross section of the retort and that of the charge, and recommended that the charge be as large as possible for the size of the retort, and that the heat should be such as would burn off the charge in a fixed time. Slicing of charges might be a good idea. Mr. Searle argued that slicing the charge would tend to reduce the production of free carbon, and diminish the risk of having stoppages in the pipes. Captain White alluded to stopped pipes and thick tar as old troubles brought about by the demand for high yields and high heats.

Mr. Earnshaw replied to the discussion, and said that the number of men required to run a retort-house depended upon local conditions and the kind of labour obtainable. He mentioned the employment of two men to four benches, in order to emphasize the fact that certain men were required to attend to, and be held responsible for, certain duties. If the fire was kept low in the grate, as was necessary if sufficient air was to be admitted above the fuel, a good white heat was required in order to raise the temperature of the combustion chamber to a full red heat before igniting the charge. All coal would make thick tar under certain conditions; but some made it more readily than others. The object of using the long basket bore every twenty-four hours was to remove a deposit as soon as it commenced to form.

A short paper on "Bagging Live Gas-Mains," by Mr. P. H. Gibbons, of Philadelphia, was read. Many mains were coated inside with dry scale, naphthalene, and rust; and under such circumstances a soft pliable rubber bag, so placed as to get an even pressure at all points of contact, made the best stopper. Sometimes the interior surface was very rough, and had little barnacles of dried tar, some of which were porous. The rubber bag would also do for this; but it did not answer when the main was not properly drained, or if oily matter was present, because the oil dissolved the rubber. A stopper or a canvas bag was better in such cases. After thoroughly draining the main, the rubber bag could be safely used; and his plan was to employ two bags at each opening, so that if anything happened to one the other would take care of the gas. To rapidly and accurately place bags in mains, he had designed an appliance which he called a bag-fork, with prongs, made of wire, that could be readily slipped over the bag clear to a distance a little greater than half the diameter of the pipe. He had used this successfully on mains from 2 to 30 inches in diameter as a means of avoiding escape of gas when fixing and inflating the bag. For canvas bags, he used a fork with wider spaces between the prongs. On intersection work, he sometimes found it convenient to drill a hole in the centre of a cross, and plug all the openings; using a bag one size larger than the mains. But if required, he could put a bag into each of the branches from the one centre hole, by means of the fork, and thus make a complete cut-off. To avoid puncturing the bag while cutting the pipe, he used a "bag shield," consisting of a piece of steel spring wire shaped to fit the main, and covered with oiled canvas. By putting a light luting of soap round the shield, it would prevent the escape of gas past the exterior of the bag.

Mr. Littlehales said that, for small mains, an ox bladder was as effective as a rubber bag. The cost was but a trifle; there was no fear of injury from oil or tar; and he had known a bladder to last as long as a bag. He always kept a stock on hand, in methylated spirit.

(*To be continued.*)

TESTS OF THE CLAMOND GAS-RADIATOR.

Report by the "Lancet" Commission.

Readers of the "JOURNAL" are aware that the proprietors of the "Lancet" have from time to time rendered great public service by instituting special investigations into subjects intimately connected with the general health of the community. If in some cases we have not been able to endorse the conclusions arrived at by the Commissioners, the fact does not in the least detract from the merit attaching to the initiation of the inquiries, or from their value as the recorded results of systematic research in a special field of inquiry. Rather more than ten years ago, the first of a series of three articles on the subjects of gas-stoves, the prevention of smoke, and the ensuring of perfect combustion, appeared in the columns of our contemporary; the concluding one being given on Nov. 26, 1893. After that date, nothing occurred to direct special attention to this subject until the application to gas-stoves of the Kern burner, which, on account of the intense heat it generates, has been so successfully applied in incandescent gas lighting. This burner, when surrounded by a perforated fire-clay tube, has the heat of its flame translated to a very large extent into radiant heat; and, as our readers are aware, the combination of these elements—the burner and the tube—forms the basis of the Clamond gas-radiator, which was described in the "JOURNAL" for the 1st of October last (p. 836). This new departure in heating by gas appeared to our contemporary to justify special investigation into the merits of the appliance by which it is effected; and accordingly experiments were instituted with the view of testing its capabilities. The tabulated results were published in the "Lancet" for the 30th ult., accompanied by explanatory remarks. We have received a copy of the number, from which we make the following extracts.

As the experiments to be described show, the Kern burner deals efficiently with the combustion of coal gas, and therefore yields a maximum heat intensity, so that it is calculated to prove a source of heat free from reproach from a hygienic standpoint; for the more intense the heat, the more effectual will the combustion be. There are two main points to be considered in estimating the value of a gas-fire—first, its heating efficiency (that is to say, the heat which it is able to realize from a given amount of gas consumed); and, secondly, the influence of the system upon the air, from a sanitary point of view. We may, of course, dismiss at once any possibility of the formation of smoke. But invisible products of coal may be not a whit less injurious; and the gas-stove that produces them and allows them to escape into the air should be summarily condemned. The experimental portion of this inquiry relates, therefore, to the heating efficiency of the Clamond gas-radiator, whether effected by radiant heat or by convection; the effect upon the air from a hygienic point of

view; the composition of the gases in the mixing chamber of the Kern burner; and the progress of combustion as determined by an analysis of the gases within the fire-clay tube or radiator, and of the gases ultimately escaping by way of the flue.

The following tables (I. to IV.) record results showing the heating efficiency of the radiator and its effect upon the air. Tables I. and II. refer to a stove (A) furnished with a hot-air chamber. It was cased in sheet iron provided with air inlets and outlets. Tables III. and IV. give the results obtained with a stove without such casing (B), so that the heating effect was due in great part to radiant heat. The experiments were all conducted in a room of 1500 cubic feet capacity. The cost of gas is assumed to be 3s. per 1000 cubic feet. The temperatures throughout are recorded in degrees Fahrenheit.

TABLE I.—*Heating Efficiency of Stove* A *and its Effect upon the Air.*

Experiment 1.—Stove with hot-air chamber, without iron curtain; pressure of gas, 3 inches; consumption, 22 cubic feet per hour.

1.—Time	4.28	4.58	5.28	5 58 .. 6.28
2.—Temperature 2 feet in front of fire	54	103	118	119 .. 119
3.—Temperature 6 feet in front of fire	52	62	66	67 .. 68
4.—Temperature of room (mean)	51	56	59	61 .. 63
5.—Temperature of currents over stove	53	184	220	221 .. 220
6.—Moisture in the air (100 = saturation)	88	82	79	82 .. 79
7.—CO_2 in the air at breathing level	5·4	—	7·10	— .. 8·0
8.—Increase of CO_2 from the start (parts per 10,000)	—	—	1·7	— .. 2·6

Result (based on two hours' working): 44 cubic feet of gas, costing 1·58d., raised the temperature 12° in two hours. Cost per degree = 0·13d., or a consumption of 3·6 cubic feet of gas.

TABLE II.

Experiment 2.—Pressure of gas, 2 inches; consumption, 20 cubic feet per hour.

1.—Time	7.45	8.15	8.45	9.15	9.45 .. —
2.—Temperature 2 feet in front of fire	52	103	112	116	120 .. —
3.—Temperature 6 feet in front of fire	52	62	64	68	70 .. —
4.—Temperature of room	52	57·5	61	63	65 .. 13
5.—Temperature of currents over stoves	52	210	220	240	250 .. —
6.—Moisture in the air	94	94	94	94	94 .. —
7.—CO_2 in the air	5 4	—	6·2	—	7·4 .. —
8.—Increase of CO_2 from the start (parts per 10,000)	—	—	0·8	—	2·0 .. —

Result (based on two hours' working): 40 cubic feet of gas, costing 1·44d., raised the temperature 13° in two hours. Each degree raised cost 0·108d., or 3 cubic feet of gas.

TABLE III.—STOVE B.

Experiment 1.—Gas pressure, 2 inches; consumption, 20 cubic feet per hour.

1.—Time	10.0	10.30	11.0	11.30	12.0
2.—Temperature 2 feet in front of fire	50	102	112	116	117
3.—Temperature 6 feet in front of fire	50	61	63	65	66
4.—Temperature of room	50	55	58	60	61
5.—Temperature of currents above stove	50	132	132	128	126
6.—Moisture in the air	91	88	88	88	88
7.—CO_2 in the air	3·5	—	4·2	—	4·4
8.—Increase of CO_2 (parts per 10,000)	—	—	0·7	—	0·9

Result (based on two hours' working): 40 cubic feet of gas, costing 1·44d., raised the temperature of the room 11° in two hours. One degree cost 0·13d., or 3·6 cubic feet of gas.

TABLE IV.

Experiment 2.—Gas pressure, 2½ inches; consumption, 18 cubic feet per hour.

1.—Time	2.0	2.30	3 0	3.30	4.0
2.—Temperature 2 feet in front of fire	53	112	115	115	117
3.—Temperature 6 feet in front of fire	53	65	67	68	68
4.—Temperature of room	53	60	63	64·5	65
5.—Temperature of currents above stove	53	130	132	132	132
6.—Moisture in air	88	88	85	88	88
7.—CO_2 in the air	3·6	—	4·0	—	4·2
8.—Increase of CO_2 (parts per 10,000)	—	—	0·4	—	0·6

Result (based on two hours' working): 36 cubic feet of gas, costing 1·30d., raised the temperature 12° in two hours. One degree cost 0·108d., or 3 cubic feet of gas.

As will be seen, the heating efficiency of the Clamond gas-radiator is very great, and we doubt whether such an output of radiant heat has ever before been attained at so little cost and so low an expenditure of gas. Thus, in the case of the gas-stoves examined by the "Lancet" Commission in 1893, the mean amount of gas required to raise the temperature was 5·4 cubic feet, costing 0·195d.; whereas with the Clamond gas-radiator the amount of gas required to effect the same advance of temperature is 3 cubic feet, at a cost of 0·108d.—nearly half the consumption and cost. The fact that the stove produces effective radiant heat is evident from the records of two thermometers—one placed 2 feet in front of the fire, and the other 6 feet. The former showed, after two hours, a temperature of from 117° to 120° Fahr., and the latter one of from 68° to 70° Fahr.; the temperature of the room being many degrees less. It is also shown that the heating effect of the stove is soon realized; the temperature of the room having been raised from 50° to 61° Fahr., in half-an-hour in some instances, with a consumption of only 10 cubic feet of gas. Nor is this heating efficiency obtained at the expense of the purity or healthy condition of the air. The degree of moisture varied only within small limits, while the increase in the proportion of carbonic acid was quite insignificant.

The following table shows the composition of the gases taken from the middle of the fire-clay tube or radiator:—

TABLE V.—*Composition (by Volume) of the Gases taken from the Middle of the Fire-Clay Tube.*

	Experiment 1.	Experiment 2.
Carbonic acid (CO_2)	5·20	5·50
Oxygen (O)	1·46	1·25
Carbon monoxide (CO)	7·08	6·50
Hydrogen (H)	6·04	8 00
Hydrocarbons	1·46	3·00
Nitrogen (N), by difference	78·76	75·75
	100·00	100·00

The results give the history and progress of the combustion. The bulk of the hydrogen and methane are evidently burnt at the lower part of the tube; while the carbon monoxide, with some hydrogen and hydrocarbon, burn in a blue fringe of flame near the top of the tube—ultimately yielding complete products of combustion, as shown in Table VI.

TABLE VI.—*Composition (by Volume) of the Gases taken from the Top of the Fire-Clay Tube.*

	Experiment 1.	Experiment 2.	Experiment 3.
Carbonic acid (CO_2)	6·76	6·08	6·00
Carbon monoxide (CO)	No trace	No trace	No trace.
Oxygen (O)	8·70	9·94	10·24
Nitrogen (N), by difference	84·54	83·98	83·76
	100·00	100·00	100·00

This table demonstrates the interesting and most important fact that in the Clamond gas-radiator the combustion of gas is complete, and without the production of those partly-burnt gases or escaping unburnt gases which are injurious to health. In no instance was the deadly carbon monoxide found, either in the gases escaping from the flue or in the air of the room, although the most approved test for this gas was applied—viz., after absorbing all the oxygen by phosphorus, the residual gas was shaken with fresh blood. The result was always negative. This is hardly surprising when we consider the intensity of the Kern flame. The result speaks highly in favour of the Kern burner as a hygienic means of warming and maintaining the temperature of a room.

A few words may be added on the management and conduct of the Clamond gas-radiator. It is easily controlled, readily lighted, and is free from that great drawback of atmospheric burners, it cannot "light-back;" that is to say, the flame never runs back to the gas-nipple. It is important that the pressure and the supply of gas should be sufficient. The Kern burner, however, is not always free from that whirring noise characteristic more or less of all gas-stoves. Improvement in this direction is desirable, and doubtless will be attained, unless the noise is an inevitable concomitant of burners through which a mixture of gas and air is passing. The heat of the Clamond gas-radiator may be easily regulated; the stove being provided with two stop-cocks, each controlling five burners. In some cases it appears to be desirable to be able to reduce the number of burners still further, so powerful is the heating efficiency. Under any circumstances, we think the Clamond gas-stove should be properly attached to a chimney-vent; the flue running through a hole provided in sheet-metal casing. The sulphur compounds inseparable from coal gas demand this precaution; while, however perfect the combustion may be, it is not desirable to diminish the proportion of oxygen in the air by adding carbonic acid gas to it.

The results of this inquiry distinctly confirm what is claimed for the Clamond gas-radiator—it gives a cheerful, healthy, radiant heat; is remarkably economical; and, as far as our experiments have gone, shows no deteriorating effect upon the air.

At advertising the gas business it must be acknowledged that our cousins across the Atlantic are adepts. But we have learnt something from them, and are now not very far behind. At all events judging from some cuttings from local papers which have lately reached us from Savage South Africa, Mr. W. Arnott, the Manager of the South African Lighting Association is keenly alive to the necessity of not hiding his light—or rather his fuel—under a bushel. In various attractive ways—by well "displayed" advertisements and the judicious editorial paragraph—he brings into prominence the advantages of gas-stoves as time, temper, and money saving appliances in the household, and extols gaseous fuel for its cleanliness and adaptability for culinary operations. Like another skilful manipulator of advertisements, Mr. Arnott brings the Bard to his aid. But no matter how it is done, if he can rub in the fact that gas-stoves, as he puts it, "come as a boon and a blessing to women," he will have gained *kudos* for himself and increased revenue for the Association. There is a breeziness about Mr. Arnott's advertisements which affords clear proof that, notwithstanding the war, martial law, and the other amenities associated just now with life at the Cape, he is by no means depressed. The Association are, in fact, showing a bold front, and, thanks to having an enterprising Manager looking after their affairs, are doing remarkably well.

TEMPERATURE CORRECTION TABLE FOR OILS.

When noticing, in the "JOURNAL" for the 1st of October, the concluding proceedings at the ninth annual meeting of the Pacific Coast Gas Association, an abstract was given of a paper by Mr. L. P. Lowe on the "Practical Mechanical Testing of Oils for Gas and Fuel Purposes." It was then mentioned that accompanying the paper were tables showing degrees Beaumé, specific gravity, weight per gallon (U.S.) at 60° Fahr., and temperature correction. With regard to the last, the author pointed out that it was quite necessary, in the accurate measurement of oil, to make corrections for any temperature greater or less than the standard one of 60° Fahr., as the expansion or contraction of the volume of oil for temperatures higher or lower than the standard was considerable. He therefore advised the use of the table for accurate work, as certain crude oils have to be heated up to from 120° to 150° Fahr. before they can be easily handled by pumping in the usual manner; and at the latter temperature the oil is expanded almost 6 per cent. by volume. As the table may be serviceable to some of our readers, we reproduce it. When using it, they should divide the apparent volume of oil by the number opposite the observed temperature.

Fahr.		Fahr.		Fahr.		Fahr.	
45	.99040	72	1.00768	99	1.02496	126	1.04224
46	.99101	73	1.00832	100	1.02560	127	1.04288
47	.99168	74	1.00896	101	1.02624	128	1.04352
48	.99232	75	1.00960	102	1.02688	129	1.04416
49	.99296	76	1.01024	103	1.02752	130	1.04480
50	.99360	77	1.01088	104	1.02816	131	1.04544
51	.99424	78	1.01152	105	1.02880	132	1.04608
52	.99488	79	1.01216	106	1.02944	133	1.04672
53	.99552	80	1.01280	107	1.03008	134	1.04736
54	.99616	81	1.01344	108	1.03072	135	1.04800
55	.99680	82	1.01408	109	1.03136	136	1.04864
56	.99744	83	1.01472	110	1.03200	137	1.04928
57	.99808	84	1.01536	111	1.03264	138	1.04992
58	.99872	85	1.01600	112	1.03328	139	1.05056
59	.99936	86	1.01664	113	1.03392	140	1.05120
60	1.00000	87	1.01728	114	1.03456	141	1.05184
61	1.00065	88	1.01792	115	1.03520	142	1.05248
62	1.00128	89	1.01856	116	1.03584	143	1.05312
63	1.00192	90	1.01920	117	1.03648	144	1.05376
64	1.00256	91	1.01984	118	1.03712	145	1.05440
65	1.00320	92	1.02048	119	1.03776	146	1.05504
66	1.00384	93	1.02112	120	1.03840	147	1.05568
67	1.00448	94	1.02176	121	1.03904	148	1.05632
68	1.00512	95	1.02240	122	1.03968	149	1.05696
69	1.00576	96	1.02304	123	1.04032	150	1.05760
70	1.00640	97	1.02368	124	1.04096	151	1.05824
71	1.00704	98	1.02432	125	1.04160	152	1.05888

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

The Winter Meeting of the Association was held on Saturday, in the Geological Society's Rooms at Burlington House, W.—Mr. FREDERICK GRIFFITH (Leicester), the Senior Vice-President, in the chair.

The CHAIRMAN, in opening the proceedings, said it was with great regret that he had to announce that the President (Mr. W. A. Richardson) was unavoidably absent owing to illness. He was sure they all condoled very much with their President in his illness; and he thought it would be fitting, before the business commenced, to pass a vote of sympathy with him. He should be pleased to move a resolution to that effect.

Mr. W. G. PEIRCE (Richmond) seconded the motion, which was unanimously adopted.

The SECRETARY (Mr. Percy Griffith) read the minutes of the annual meeting held at Birkenhead in July last; and they were confirmed.

It was next announced that Mr. A. B. E. Blackburn had been transferred by the Council from the class (A) of associates to that of member.

ELECTION OF NEW MEMBERS AND OFFICERS.

The Scrutineers collected the balloting-lists for the election of new members and the officers for the ensuing year. Subsequently they reported that the roll of the Association had been extended by the admission of the following gentlemen:—

Members.—Mr. H. T. Blake, of Ross (Herefordshire); Mr. R. Clarke of Dawlish; Mr. A. H. Cooper, of Wey Valley, Surrey; Mr. W. M. Jones, of Birkenhead; Mr. H. G. Keywood, of Maldon; Mr. Baldwin Latham, of Westminster; Mr. F. B. Latham, of Penzance; Mr. J. Lund, of Rockhampton (Queensland); Mr. W. Maughan, of Holmfirth; Mr. F. Noake, of Manningtree; Mr. R. Peirce, of Singapore; Mr. A. E. Prescott, of Douglas, Isle of Man; Mr. J. W. Webster, of Cowes, Isle of Wight; and Mr. H. W. Woodall, of Bournemouth.

Associates.—Mr. J. S. Bird, of Walsall; Mr. F. H. Brunt, of Manchester; Mr. C. H. Chapman, of Salford; Mr. C. F. Coker, of Halling, Kent; Mr. C. W. Harrison, of London; Mr. R. W. Hedley, of Westminster; Mr. J. T. Hiscox, of Westminster; and Mr. C. D. Pearson, of Port Talbot, South Wales.

The CHAIRMAN remarked that the number of new members and associates was 22; making the total elected during the year nearly 40.

The examination of the balloting lists for officers disclosed the following elections:—

President.—Mr. Frederick Griffith, of Leicester.

Vice-Presidents.—Mr. R. H. Swindlehurst, of Bolton; and Mr. F. J. Bancroft, of Hull.

Members of Council.—Mr. Charles Gilbey, of Bath; Mr. C. E. Jones, of Leyton; Mr. W. Millhouse, of Scarborough; Mr. H. W. Pearson, of Bristol; Mr. C. Sainty, of Windsor; Mr. W. Terrey, of Sheffield; Mr. E. A. B. Woodward, of Wolverhampton; Mr. Thomas Bower, of West Hartlepool; Mr. P. H. Palmer, of Hastings; and Mr. James Deas, of Warrington.

Hon. Secretary and Treasurer.—Mr. W. G. Peirce, of Richmond.

THE ANNUAL MEETING.

The CHAIRMAN, having thanked the members for the honour they had conferred upon him by electing him to the presidency, said he should be delighted to invite the Association to visit Leicester for their next annual meeting. The water-works there were of a type which he thought would be of great interest to the members. One of the reservoirs was constructed under the Local Act of 1847; others under the Act of 1866; and others under the Act of 1890. Therefore they had water-works both ancient and modern; and they illustrated the development which had been made in construction since the beginning. He had mentioned to his Chairman that he intended asking the Association to visit Leicester; and he had generously promised to support him (Mr. Griffith), and would be pleased to meet the members, and to interest himself in their comfort.

PAPERS READ.

The remainder of the sitting was occupied by the discussion of papers. The first was that read by Mr. W. INGHAM (Torquay), at the annual meeting, on "The Design, Construction, and Cost of Open and Covered Service Reservoirs." The discussion was very full. A paper by Mr. A. G. CLOAKE on "French Practice in the Manufacture of Cast-Iron Pipes;" one by Mr. S. H. TERRY, M.Inst.C.E., on "English Practice in the Manufacture of Cast-Iron Pipes;" and an abstract of articles published in "The Engineer" on American practice in the same line, furnished material for a second solid discussion. Mr. Ingham's paper has already been summarized in the "JOURNAL," and abstracts of the other papers and a report of the discussions will appear in early issues.

Mr. INGHAM, at the close of the discussion on the last papers, suggested the formation of a Committee to take into consideration the question of the standardization of cast-iron pipes.

The CHAIRMAN said the Council would consider the matter, and, if thought fit, make a recommendation in regard to it.

THE ELECTION OF COUNCILLORS.

Mr. W. JONES (Pontypridd) raised a question as to notice being given regarding the nomination of new members for the Council.

The SECRETARY pointed out that the rules gave full information respecting the matter, and provided that nominations should be sent to the Secretary 31 days before the winter meeting.

Mr. JONES said he should give notice of a motion for amending the rule, in order that the members might receive a notice reminding them of the date by which nominations should be sent in. He pointed out that all the nominations on the balloting-list this year were submitted by the Council.

A vote of thanks to the President and Council of the Geological Society for the use of their rooms was unanimously passed; and the Chairman was also thanked for presiding.

STORING, ANALYZING, AND TREATING WATER.

[Abstracts of Papers, with the Discussions thereon, presented to the Conference on Water Supplies and River Pollution.]

THAMES WATER SUPPLY AND STORAGE.

This was the title of a second paper contributed by Mr. H. W. Russell, of the Berkshire County Council. The author remarked that the conditions of the flow of the River Thames had very much altered during the latter half of the century just closed. It might appear a paradox, but it was nevertheless true, that the same causes which produced floods also produced droughts; and the upper river districts suffered quite as seriously from the latter as from the former. During the period mentioned, landowners all over the watershed had laid down millions of drain-pipes, with the result that the rainfall was rushed into the river with great rapidity. The water no longer remained on the land for a sufficient period to enable a large portion of it to percolate through and replenish the springs; but, especially in the late autumn, when active vegetation had ceased to absorb a large quantity of moisture, an abnormal amount of the rainfall, undiminished by the action of absorption by the soil, ran direct into the river.

The channel of the river was quite inadequate to the sudden strain, and more or less disastrous floods ensued. The half-submerged towns on the banks clamoured for relief; and the severest pressure was put on the Conservancy to get rid of the water as quickly as possible. Fresh weirs were constantly being

constructed, each with a still larger capacity for facilitating the escape of the water; and they saw every year an enormous mass of water rush down to the sea, the want of which they knew would be felt a few months later on. This difficulty was steadily increasing, and pointed to the conclusion that some effort should be made to retain a portion of this bountiful excess to secure London at least from shortness of supply.

It had been urged by some that, as a consequence of cultivation and deep drainage, the level of the subsoil water had been lowered, and a larger depth of soil made available for the absorption of the rainfall. But it must be pointed out that, to carry into effect the deep drainage, it had been found necessary to provide deep and clear channels to get rid of the surplus water; and this had had the effect of increasing the rapidity of the rise of the water in the river, and, in the opinion of the writer, more than compensated for the reduction due to the greater depth of soil available for absorption. Still, supposing the causes adduced were erroneous, the fact remained patent to everyone familiar with the river for the last forty or fifty years, that the rise of the water, after comparatively moderate rainfall, was of a much more sudden and acute character than in former times, and that a large amount of water, instead of running to waste, might with advantage be abstracted. In support of these views, the author gave the following instances of enormous increases in the flow over Teddington Weir within a few days:—

	Mill. Galls.		Mill. Galls.
1884.—Jan. 23	960	1891.—Oct. 6	400
,, 28	4055	,, 9	2530
1885.—Jan. 28	675	1892.—Oct. 27	366
Feb. 3	3145	,, 30	3089
1885.—Nov. 24	880	1894.—Oct. 23	363
,, 28	3630	,, 28	2038
1886.—Dec. 4	990	1896.—Dec. 3	887
,, 10	3590	,, 6	4293
1888.—Mar. 5	660	1898.—Nov. 24	737
,, 12	3200	,, 26	2615
1888.—July 27	860	1898.—Dec. 6	793
Aug. 3	3156	,, 9	3472
1889.—May 25	880	1900.—Feb. 14	1111
,, 28	3105	,, 17*	8747

The following facts regarding the flow of the River Thames should, thought the author, remove any doubt which might exist as to the capability of the river to spare the large quantity of water which was required to supply the Metropolis. The area of the watershed of the River Thames, above the intakes of the Water Companies at Hampton, was 3548 square miles, and the average rainfall about 28 inches per annum. The average flow of the river, gauged at Teddington Weir for a period of eighteen years, was about 1128 million gallons per day:—

Natural Flow of the Thames at Teddington.

Maximum flow on Nov. 18, 1894	about 20,000 mill. galls.
Minimum flow on Sept. 13, 1898	,, 176 ,, ,,

Monthly Average per Day.

Maximum in November, 1894	6,465 mill. galls.
Minimum in September, 1898	214 ,, ,,

Yearly Average per Day.

Maximum in 1883	1,922 mill. galls.
Minimum in 1898	760 ,, ,,

It would be seen from these figures that, with a daily average flow of over 1100 million gallons, there was ample excess to provide storage for eighty or ninety days' supply of London, which would probably satisfy all prudent requirements, without at all interfering with the quantity necessary for navigation and properly scouring the channel and preventing accumulation of mud below Teddington Weir. When the reservoirs at Walton and Staines, now in course of construction, were completed, there would be storage for 8000 million gallons of unfiltered water.

The author remarked that though he was not dealing with any other river than the Thames, in considering the question from the point of view of the London supply, it must not be forgotten that the reservoirs in the Lea Valley, constructed or in course of construction, also had a capacity of nearly 8000 million gallons. The present average daily withdrawal of water from the Thames by the Companies amounted to 118 million gallons, or equal to about 10 per cent of the average flow of the river.

In dealing with the future, they came upon highly debatable ground. The question of the increase of population was one upon which experts of equally high authority held diametrically opposite opinions. The allowance to be made for evaporation and loss incurred by the proposed vast storage areas, seemed to be quite problematical, and a matter for hopeless disagreement between the great authorities on such subjects.

The writer thought it safest to adopt the conclusions of the Royal Commission on the Water Supply of the Metropolis, issued as recently as 1899, which were that in 1941, with an estimated population for Water London of a little more than 12 millions, the supply required would be 423 million gallons a day, of which the Thames would have to contribute about 300 million gallons, or roughly about one-fourth of its average daily flow. Eighty days' storage for this quantity would mean accommodation to be provided for 22,000 million gallons in excess of that already constructed or being constructed.

The author believed that there was an ample excess of water at times which could be abstracted with advantage to the river to provide for this quantity; and he was of opinion that, if this question were argued solely on its merits, without reference to any competing scheme, the conclusion arrived at by the general public would be in accordance with the views expressed in the report of the Royal Commission.

* This was largely owing to the sudden melting of a heavy snowfall; the ground being frozen, and incapable of absorbing any of the water.

Discussion.

The CHAIRMAN (Mr. William Whitaker, F.R.S.) said that a most important statement in the paper was that the conditions of the flow of the River Thames had very much altered during the latter half of the century just closed. This showed how dangerous it sometimes was to trust too far to statistics. They must allow that things had changed, and that they would change again. Nature changed, and it always would change. There were some figures given in the paper which showed the continual fluctuations. For instance, in October, 1894, the flow over Teddington Weir varied from 363 million gallons on the 23rd, to 2038 million gallons on the 28th; but they were told that in November (on the 18th) there was a maximum flow of 20,000 million gallons, which was much larger.

Mr. D. CAMERON (Exeter) said the question had been touched upon that a river water supply was necessarily bad. As he held a different opinion, he should like to make a few remarks on this subject.

The CHAIRMAN, however, pointed out that there had already been ample opportunity of discussing the matter of pollution. They must stick to the questions of storage and supply which were dealt with in this paper; and the word pollution must not be uttered.

A NOTE WITH REFERENCE TO WATER STANDARDS.

Mr. H. R. Kenwood, Medical Officer of Health and Public Analyst for Stoke Newington, stated that the object of his note was to draw attention to a recent incident which had destroyed his faith in the value of a chlorine standard for water analysis. The Medical Officer of Health of a rural district in the South of England consulted him with reference to a sample of the well water supplying a small public institution in which an exceptional outbreak of dysenteric diarrhœa had occurred. The result of Mr. Kenwood's chemical analysis of the well water was to leave some doubt in his mind as to whether the water might or might not have been concerned in causing and maintaining the outbreak. The facts of the analysis were as follows:—

Appearances in 2-feet tube	Clear, no deposit, very faint yellowish tint, well aërated.
Reaction	Alkaline.
Total solid matters—	43·2 parts per hundred thousand.
(*a*) Fixed	32·5 ,, ,,
(*b*) Volatile	10·7 ,, ,,
Appearance on ignition	*nil.* ,, ,,
Total hardness—	26·2 ,, ,,
(*a*) Permanent	9·5 ,, ,,
(*b*) Temporary	16·7 ,, ,,
Chlorine	3·2 ,, ,,
Nitrogen as nitrates	0·24 ,, ,,
Oxygen absorbed from permanganate in 2 hours at 80° Fahr.	0·330 part per million.
Saline (or free) ammonia	0·035 ,, ,,
Organic (or albuminoid) ammonia	0·028 ,, ,,
Lead, copper, iron	*nil.*
Nitrites	*nil.*
Phosphates	Very faint trace.
Sulphates	Marked.

Most analysts would have passed this water as not likely to be polluted with harmful organic matter; and he should have done so himself had not the facts established a strong *primâ facie* case against the water. The author inspected the locality, and, along with the Medical Officer of Health, investigated the origin of the outbreak. They succeeded in discovering a hitherto unsuspected source of pollution, and satisfied themselves that the water was, as a matter of fact, polluted from that source, which was some 300 feet distant from the well.

The instructive circumstance was this: The medical officer had established a "chlorine standard" for this particular water; and the chlorine figure—in some sixteen analyses extending over three years—was fairly constant at 3·2, and had never varied beyond 3·1 and 3·3 parts per 100,000. He had carefully estimated the chlorine on three occasions shortly before submitting a sample of the water to the author; and finding that it conformed to the standard, he had persuaded himself that the water was not likely to have been concerned in the outbreak. He had not therefore made a complete analysis, because he did not consider that a complete analysis was necessary. The chlorine figure in this instance proved absolutely useless for the purpose of detecting animal pollution. The only standard which would have certainly led to the detection of the pollution would have been one of the free and saline ammonia; and Mr. Kenwood was satisfied that, in the majority of waters, this was the best indication of dangerous pollution, and the safest standard to adopt. Whatever other quantities obtainable by analysis were fixed as standards, one must never neglect the ammonia figure, which was of paramount importance.

In some analyses he had made with water polluted with 1 per cent. of average crude sewage, the free ammonia increased 125 times; but the albuminoid ammonia was only increased about five times, the oxidizable organic matter twice, the total solids by only about 1 part per 100,000, and the chlorine to 1·98, as against 1·90. Taking the same water polluted with 0·1 per cent. of the same crude sewage, the free ammonia was increased about 13 times; but the

albuminoid ammonia was increased by not much over one-third of its original quantity, the total solids were practically the same, and the chlorine showed no appreciable increase.

The only waters in which the free and saline ammonia figure would not serve to indicate the faintest quantities of pollution were those exceptional ones in which the ammonia was very high, as a consequence of the reduction of oxidized nitrogen (greensand waters, &c.). In these waters, a very faint increase in the ammonia, due to animal pollution, might be missed. With the exception of this class of waters, any but the merest trace of ammonia should be regarded with suspicion, for it was rarely found save in recently polluted waters. This might be accounted for by the fact that the more readily oxidizable organic substances were responsible for a delay in the oxidation of the ammonia by oxidizing organisms.

The conclusions which the incident related by Mr. Kenwood gave rise to were: (1) That the chlorine standard figure was useless for the purpose of detecting the smaller degrees of dangerous pollution. (2) That before giving an opinion as to the safety of drinking a particular water, it was of the greatest importance that a careful local investigation should be made for all possible contaminating influences, having regard to the source of the water; and that the circumstances which called for the analysis of a particular sample should always weigh with one in deciding upon the degree of purity which would justify the acquittal of the water as a possible agency in promoting disease.

Discussion.

The CHAIRMAN said that he himself had often felt the want of complete analyses, without which they really could not come to a definite conclusion. Mr. Kenwood remarked, with regard to the case he instanced, that "the only standard which would have certainly led to the detection of the pollution would have been one of the free and saline ammonia." He (the Chairman) thought they should never rely upon one thing alone. In some cases only one particular branch of analysis might give them what they required, but, as a general rule, they ought not to trust to any one thing in these matters.

Mr. BOSTOCK HILL (Birmingham) remarked that the subject brought forward was one of great importance to them. Mr. Kenwood pleaded, as he (Mr. Hill) did two or three years ago in a paper he published, for the necessity of full and complete examination of samples of water. He would like to give the following example to illustrate the need for this. A certain township in the Midlands possessed a public water supply which had, at comparatively rare intervals, been analyzed by him. On one occasion, he received a sample, without having any explanation as to its origin, other than that it was an ordinary sample of the supply. When analyzed, the result was such that, unless he had known the previous condition of the water, he should have been inclined to pass this sample as safe, so far as chemical analysis could indicate. But before giving a definite report on the water, he wrote to the authorities asking if there were any conditions then operative which did not previously exist. To this inquiry he received no answer. Several months afterwards, however, he learned that there had been over a hundred cases of typhoid, which were put down to local contamination of the water supply. He cited this as an instance of the inadvisability of adopting any particular standard. There should in all cases be a full analysis, not only chemical, but also bacterial. They must not, however, expect too much from bacterial analysis. It was wonderfully useful, particularly in the case of public water supplies, in showing any change in the way filters were doing their work; but though they did not find the germs of typhoid by this means, they must not necessarily conclude that the water was safe. In most of the big epidemics of typhoid of late, the disease organism had not been found. He wished to protest at the present time against what was done by so many councils and authorities in endeavouring to get analyses of public water supplies made as cheaply as possible. This was largely the *crux* of the whole matter. He was often asked for how much he would analyze samples of water. It was this endeavour to get the lowest possible tender, and not really an opinion based on the best material at disposal, that created many of the troubles he had found in connection with water analysis. They were much indebted to Mr. Kenwood for bringing forward the necessity for the fullest analysis that could be made; for it was only by insisting on full analyses of public water supplies that they could be on the safe side. With regard to the particular analysis instanced by Mr. Kenwood, he was bound to say that, if he had not known anything about the water, he should certainly have had some suspicion. The figures, to his mind, unless they could be explained, indicated that there was a danger lurking beneath the surface. It was, however, only by a full analysis that they would be able to tell for certain.

Mr. KENWOOD, in reply, said he was in complete accord with the remarks made by the Chairman. He had always been a consistent advocate of full analysis of water; and it certainly was not his intention, in writing his paper, to imply that he favoured any standard whatever. His sole object had been to attack a standard generally adopted by medical officers of health in reference to waters which had to be periodically analyzed. Of course, every medical officer of health and analyst, when he had a sample of water sent to him of which he knew nothing, performed a complete analysis; that was not the point. But many of them had to watch water; and in these cases, he did not think it was desirable to go beyond getting out one or two quantities. It was absolutely useless, and was unnecessary to make a complete analysis. Many quantities were every week the same. The reason he had brought the matter forward was because of the recent experience he had had, where a medical officer of health had attached a very great deal of importance indeed to the chlorine figure. He could assure them that it was a by no means unusual thing for those who were consulted with reference to water supplies which they had to watch to make a few careful and complete analyses in the first place, and then get down to one or two quantities each week, which they considered would—and which in the vast majority of cases did—indicate the addition of any impurity in that water. Mr. Hill to a great extent hit the nail on the head when he spoke of a price being asked for analysis. It had been his experience; and he expected it had been the experience of many others. Very often the authorities accepted the lowest tender; and in one or two cases, this had been 2s. 6d. per sample. If a district council wanted their water analysis done at this price, nothing more than the chlorine figure would be got out; and it would be cheap at that price. In all probability, the chlorine figure would not be correct. He hoped he had not anywhere in his paper advocated the adoption of any one particular standard. He fully recognized that in the vast majority of cases it was very desirable indeed to adopt several standards; and among these, he thought free ammonia was the only one, short of a complete analysis, which would enable them to detect very faint traces of probably harmful pollution.

THE PURIFICATION OF WATER.

Dr. Samuel Rideal, in a paper on the above subject, remarked that the interim report of the Royal Commission on Sewage Disposal had differentiated between natural and artificial processes of sewage purification. Artificial processes, however, could only be successful so far as they adhered to natural methods. Any attempts at classifying the methods of water purification on these lines would be misleading, as nearly all methods used for effecting the purification of water were parallel to those which occurred in nature. The general use of open sand filters for the major portion of the last century had brought about a greater purification in water supplies than was originally intended, inasmuch as the primary idea of the open sand filter was simply to remove suspended matter, and it was only within the last fifteen years that it had been known that such sand filters, in addition, improved the bacterial quality. The most important point in judging of the purity of a water supply at the present time was certainly the typhoid fever death-rate, and next to it the general bacterial purity of the water. Turbidity, hardness, and the effect in causing incrustation on boilers, were now minor considerations, and, in a sanitary sense, of little value. It was, therefore, necessary to reconsider the older methods of purification now that the factors of purity had this sequence of importance. Sedimentation in storage reservoirs, and the different methods of softening, although primarily designed for the removal of suspended solids and mineral matter in solution, also effected a considerable bacterial improvement; so that these methods of purification had, in common with sand filtration, accidentally rendered the water of better quality in those features which at the present time had the greater importance.

Dr. Delépine had recently shown (in the "Journal of State Medicine") that, in the natural purification of running water, one might draw the following conclusions: (1) That sedimentation was a very important factor in the bacterial purification. (2) That the effects of sedimentation were most marked when the flow was at such a rate as to allow by gravity the suspended matter to deposit, while removing the products of bacterial multiplication. (3) That agitation, by interfering with this rule, hindered the purification. The improvement effected by service reservoirs could be attributed to similar causes.

Although sedimentation and filtration thus both only indirectly attained bacterial reduction, a combination of the two processes could be so arranged as to bring the number of bacteria well below Koch's standard of 100 per c.c., and, when well conducted, was capable of yielding a water, hygienically, nearly as good as a germ-free water produced by heat sterilization, Pasteur-Chamberland filtration, or chemical treatment. By using lime as a precipitant in the storage reservoir, and a portion of the resulting precipitate as the coagulant to form the artificial *schmutzdecke* in a mechanical filter, a combination of the same effective character was possible. At Cincinnati, a process on these lines was tried in 1899; and a somewhat similar method of purification was contemplated for the Washington water supply. Even with protected upland gathering-grounds, purification plant seemed desirable, especially for the seasonable removal of algoid growths; and although the work was less than that with a river supply, it only differed from it in a degree. The use of lime as a coagulant in the storage reservoir in this case further ensured the absence of plumbo-solvent properties of the water; and as the bacterial reduction required was less, filtration, if resorted to, could be augmented in rate.

The bacterial purification in the English open sand filtration, as measured by the reduction in the number of organisms, did not, apparently, represent the true value of this method of filtration, as examination of the species of the organisms present in the water, before and after filtration, seemed to show that an open sand filter, when properly working, caused a greater percentage reduction of the *coli communis* group, and therefore presumably of typhoid, than of the non-pathogenic organisms. Such filters, therefore, had a selective bacterial action which

again, accidentally made their use desirable towards diminishing the typhoid death-rate. A discussion on this subject at the present time might be usefully directed towards the question whether purification of public supplies on the above lines should aim at the whole supply being purified up to the maximum standard of a good drinking water, or whether they should be content with a somewhat less purified water for the general supply, and sterilize separately in each house such portion as would be required for food purposes. It was probable that a gallon per head per day of sterilized water would be sufficient for drinking and culinary use, so that only from 2 to 5 per cent. of the total supply would need to be hygienically perfect. The methods for ensuring the absence of pathogenic organisms in the small quantity of water required for drinking purposes could be divided into heat sterilization, candle filtration, and chemical treatment; and in reference to these the author submitted the following brief observations.

(1) Although many methods of heat sterilization had been brought before the public, yet none seemed to have been sufficiently practical to warrant general adoption. Theoretically, it was possible to kill off all organisms by subjecting the water for a sufficiently long period to an adequate temperature. On the regenerative principle, this should be capable of being carried out without the loss of any heat or the application of any except the initial energy; but, in practical working, a slight loss of heat at present seemed inevitable. Difficulties arising from the deposition of lime salts in the tubes of such apparatus required to be overcome; but a preliminary softening in connection with the storage reservoirs, as indicated above, would diminish this objection considerably.

(2) In the struggle for existence of the many types of domestic filter, the Pasteur-Chamberland candle seemed to be the only one destined to survive.

(3) Chemical sterilization could only be regarded as an emergency method. The considerable total of even the cheapest chemical required, apart from the labour and trouble involved, must necessarily render such a method an expensive one.

The author remarked that Dr. Parkes and himself had quite recently advocated the use of bisulphate of soda as an anti-typhoid, especially for waters which contained a large amount of organic matter. Most investigators had, however, favoured the employment of oxidizing agents in some form for sterilizing waters. The efficiency of oxidizers must obviously be influenced by the amount of organic matter present in the water; and the varying quantities recorded as necessary by different observers were due to this cause. Permanganate, for example, seemed, according to recent reports, to have failed as a cholera preventive in Indian wells. In water supplies from which the greater portion of the organic matter had been removed by some preliminary process, the quantity of oxidizing agent required was so small that it would have no injurious effect upon the consumer. Ozone had the advantage over all others of being easily obtained everywhere from atmospheric oxygen; and recent progress in ozone generators and electric supply led one to believe that this oxidizing agent could be economically produced. So much was this the case, that ozone had in several directions been tried for even purifying public supplies on a large scale, and might in the near future be used extensively as a "finisher" in the purification of water. Dr. Rideal concluded his paper by giving a useful table showing the various chemical processes tested for purifying purposes during recent years.

Discussion.

Dr. Rideal (in view of the fact that incomplete copies of his paper had been handed to many of those present) said he would amplify some of his points. The present methods of water purification, he remarked, might be based upon sedimentation and filtration. These were both methods devised for removing suspended matter from water. It had only recently been discovered that, besides this, they removed bacteria; and it was thus merely by accident that filtration and sedimentation had brought about improvement in waters in this respect. It was now possible, by a combination of sedimentation in the reservoir followed by sand filtration, to produce a water which might be regarded as fairly good bacterially—that is, well below the standard of 100 per c.c. But such waters were not hygienically pure, inasmuch as among the hundred bacteria there might lurk one typhoid. In America, improvements were being carried out in this matter. The addition of lime in the storage reservoir carried down more of the suspended matter than did the ordinary sedimentation; and not only did it do this, but it removed a larger quantity of the bacteria. By taking a portion of the resulting precipitate from the storage reservoir to mechanical filters, the lime could be used on the top of the filter similarly to the film that formed in the ordinary sand filter. This would produce in the mechanical filter more efficiency certainly than in a sand filter. Therefore, by the addition of lime to the storage reservoir, and the use of a mechanical filter with the resulting precipitate as a coagulant, they had a combination which brought about a very marked bacterial improvement in the water. Experiments were carried out on these lines two years ago at Cincinnati; and they were remarkable for their results. At the present time, it was proposed to introduce a somewhat similar system in connection with the water supply of Washington. Even with protected gathering-grounds, they could not be certain of obtaining a pure water supply; and it was important even in these cases to take steps to prevent pollution. These gathering-grounds usually contained waters which acted upon lead; and it was therefore necessary to add lime to such waters. Now if lime was added so as to bring about sufficient hardness to prevent this action, the result was to also remove any bacterial contamination; and this seemed to indicate that the addition of a small quantity of lime was desirable. Mr. Verney, in his paper, advocated the usefulness of soft water. This was a subsidiary point altogether; but by using lime as a softener, it was possible at the same time to bring about an improvement of the water from a hygienic standpoint. These were methods he indicated as means of establishing improvement; but after all they must be looked upon as being applicable on a large scale, and in addition to these they might consider whether it was not possible at the present time to have a fraction of the water supplied brought up to the ideal standard of purity—germ free. The actual quantity of water drunk per head was less than 1 gallon per day; while the total quantity supplied was 30 gallons per head. Therefore the amount that it was necessary should be quite pure was not much above 3 per cent. of the whole. To secure water in this ideal condition, there were three courses open. The first of these was heat sterilization; and he suggested that this was a matter well worth the attention of water engineers. They should consider whether it was not possible to heat-sterilize the one gallon per head per day required for drinking purposes. Theoretically it should be possible to carry this out without the loss of any heat or the application of any except the initial energy; but, in practice, of course, a small quantity of energy had to be added. The second course was to adopt one or other of the different methods of filtration; and in regard to these he had said in his paper that "in the struggle for existence of the many types of domestic filter, the Pasteur-Chamberland candle type seems to be the only one destined to survive." The third plan was chemical sterilization; and in connection with this he had given the different kinds of chemicals that had been proposed for bringing about sterilization of water. An important point to note was the relatively small quantities that were required to effect the sterilization of water, as contrasted with the very large amount needed for the sterilization of sewage. This was due to the fact that most of the chemicals proposed for purifying water were oxidizing agents. Now, these oxidizing agents, before they killed the bacteria, were acted upon by the organic matter present in the water; and therefore when they sterilized sewage by chemical means, they had to employ a large amount to kill the organisms. When, however, they came to treat drinking water, the quantity of organic matter present was so small that the amount of oxidizing agent that was necessary to produce a germ-free water was very limited. There were many of these oxidizing agents; but the one most likely to come into use was ozone, which was at the present time being tried at one of the London Water-Works, and abroad on a large scale.

Mr. Thomas Caink (Worcester) remarked that Dr. Rideal, in his paper, said: "The most important point in judging of the purity of a water supply at the present time was certainly the typhoid fever death-rate, and next to it the general bacterial purity of the water." It was in support of this statement that he wished to bring before the Conference a few facts taken from his experience in connection with the typhoid rate in the city of Worcester and its water supply. The water was derived from the River Severn, which was by no means free from pollution. The River Stour, which was greatly polluted with manufacturers' waste and sewage, joined the Severn 15 miles above the water-works intake; and many towns and villages also contributed to the pollution. Prior to the year 1894, the number of cases of typhoid annually occurring in the city caused considerable anxiety to the authorities; and as suspicion rested upon the water supply, owing to the frequent unsatisfactory reports of the Analyst, the question of abandoning the source of supply was under consideration. Most of the experts engaged advocated a supply from the new red sandstone, about 15 miles from the city. On the advice, however, of their own Engineer, the Council finally resolved to adhere to the Severn, and increase the filtering area by 70 per cent. This work was completed in 1894. Previous to this time the typhoid rate was 150 per 100,000 per annum; the greatest number of cases occurring between September and March of each year. After the completion of the new filter-beds, he was extremely anxious to ascertain the effect on the typhoid rate during the next winter. When he saw that the number of cases (which for the winter half of the four preceding years had averaged 52) fell during the half ending March, 1895, to six, he was greatly gratified. The question, of course, arose: Was this entirely due to the improvement in the quality of the water, or was it a happy coincidence? The Medical Officer in the first year did not venture to report that the altered condition of affairs was due to the water. In the second year he was a little more confident; and in the third year he stated that the evidence was too strong to resist. This marked drop had, with slight exceptions, been maintained ever since; and the typhoid rate for Worcester was now much lower than that of many towns deriving their water from wells.

Mr. J. Parry, M.Inst.C.E. (Liverpool) said that Dr. Rideal raised the question of different methods of purification; but this was scarcely a matter which could be dealt with at that Conference. He, however, strongly deprecated the suggestion made by Dr. Rideal that they should be satisfied with a relatively low standard of purification for water supplies, and rely to a large extent on private and automatic purification for the small quantity of water required for domestic purposes. This would be fatal, and would end in nothing but disaster. He did not want it to go

forth to the public that the Conference encouraged, in any shape or form, anything tending to lower the standard of purity that they aimed at producing in their water.

Mr. JAMES WATSON, M.Inst.C.E. (Water Engineer of Bradford) said that long before the Cincinnati application of lime to counteract the effect of those waters which acted so energetically on lead, the Corporation he served adopted the system. One of their high moorland waters was very active in this respect. Plumbism was so bad that the medical officers worried them all round. The method adopted was to apply to the water 3 grains of carbonate of lime to the gallon; and within a very short time lead poisoning was unknown. This was a process of hardening soft water. The other extremity—too hard water—was remedied, according to Dr. Clark's system, by adding lime to it to soften it. A most curious thing was that, after adding all these thousands of pounds of lime, and putting the coagulant on the filter-beds, they saw but the thinnest white skim. Hundreds of analyses they had had made had never been able to indicate more than an addition to the hardness of the water of ¾ grain; and he had all these years been wondering where the balance went to. Dr. Rideal, when speaking of sterilizing water, seemed to think that all the human family required was one gallon per diem for drinking purposes. But some of them had to supply water to very large populations, and spend millions of pounds of the ratepayers' money in the construction of works; and it puzzled him to know how it would be possible to arrange the distributing system so as to furnish the sterilized water for the multifarious purposes for which it would be employed in addition to drinking. This industrial country could not live without large volumes of water for trade and commerce; and even London itself could not divide up its distribution systems for supplying various classes of water. It was a physical impossibility; and while they were often told that taxation was but a sign of a higher civilization, he was sure that even the taxation of London could not attain to this standard of purity. "Pure" was a very empirical term. Years and years ago discussions took place as to whether people were more healthy in soft water districts than where hard water was supplied. He remembered that when the Loch Katrine works were under consideration, a deputation went to America to ascertain whether the soft character of this water would not have a deleterious effect on the people using it. But hard water and soft water were relative terms; and to call one purer than the other was rather misleading.

Mr. J. W. BURGESS (Liverpool) said he wished to allude to the statement in Dr. Rideal's paper to which Mr. Caink had already referred—namely, "the most important point in judging of the purity of a water supply at the present time is certainly the typhoid fever death-rate, and next to it the general bacterial purity of the water." He thought it would be better to put these two matters in the reverse order. What the water authority, at any rate, had to do was to see to the purity of the supply. In Liverpool, they had a bacteriological examination of the water every day; and they did not go upon the cheap-and-nasty plan, but employed the highest authority they could secure. The results they obtained were exceedingly good—in fact, they were practically speaking perfection. He wished to make some small protest against certain charts which had been placed on the walls of the hall, without any attempt to explain them, but evidently with the intention of inducing those present to believe that a river water supply properly filtered was better than a natural water supply. He could not himself see how water which was absolutely pure at its source could possibly be worse for drinking purposes than filtered sewage.

Mr. BOSTOCK HILL (Birmingham) thought it rather strange that nearly every speaker on this paper had taken the same sentence as his text. He also, when reading the paper, had made a mark against the same words. He wanted to protest against the universal applicability of the statement that "the most important point in judging of the purity of a water supply at the present time was certainly the typhoid fever death-rate." It was a very important point. In the past the Local Government Board had practically led public opinion in the matter, and they had rather laid it down as an axiom that all typhoid fever epidemics arose from polluted water; but they had now thrown over this hard-and-fast idea. If they were to contend that the water supply was always responsible, they would often act unjustly. Most epidemics of typhoid occurred in parts of a town only; and then it was practically certain that the water was not the cause. Yet in any particular year it might be said that the supply was bad because at that time the fever rate was high! He had in the present year investigated three fairly large epidemics of fever; and in two of these the water supply was certainly not in fault. In fact, it was a strange coincidence that two of the supplies were the purest in the country, and yet the districts had the highest fever rate. A water supply must not therefore necessarily be condemned as impure because typhoid cases happened to be numerous. Wells still existed in many towns; and the fever rate might be due—if due to water at all—to these wells, rather than to the general water supply. Then again, as a Medical Officer of Health, he protested against the idea conveyed in Dr. Rideal's paper of purifying water after it had been delivered. He thought this was a wrong way of looking at the matter, and that water which was considered fit for public supply should not need any purification at the hands of the householder.

A DELEGATE said he understood Dr. Rideal, in referring to the lime process in use in America, to describe the action it had in the filter after it had passed from the storage reservoirs. He presumed Dr. Rideal was speaking of mechanical (not sand) filters.

Dr. RIDEAL wished to say that he did not advocate a method of domestic purification. He had pointed out that there were three systems at present available for producing an ideal water after it left the filter-beds; but the work should be carried out by the municipality or by the water company. The heat-sterilization apparatus should be put in by the authorities; and with regard to the chemical methods, these might be applied at the works—the ozoning, for instance. The thing to do was to render the water perfectly pure just before it reached the consumer; but how this was to be done was the question. If those responsible put into a house the heat-sterilization plant or a filter for the one gallon of drinking water, then the remaining 29 gallons per head for other purposes could be used in its present state of purity.

THE VALUE OF SOFT WATER.

The last of the papers presented to the Conference was one by Mr. Frederick Verney, of the London County Council, dealing with the commercial, industrial, and sanitary value of soft, as compared with hard, water. He quoted from a pamphlet written in 1865 by the late Mr. J. F. Bateman, to the effect that "when the Loch Katrine water was introduced into Glasgow, it was estimated, on the most careful computation, that the economy which resulted in domestic establishments was equal to the whole rate for the water supply, or £36,000 a year, upon a population of 400,000 persons; and this was by the substitution of water of about 1° of hardness, as compared with the water of the Clyde, which varied from 7° to 9° of hardness. The saving in trading establishments, where water was used for delicate operations, could not be fully estimated; but in the article of soap alone, it saved five-eighths of all that had been previously used, and probably a like proportion in dry-drugs and chemicals." Mr. Bateman went on to apply the calculations that he had made and proved at Glasgow for the benefit of London; and he said: "Assuming these figures to be correct (and the facts were most carefully worked out at the time), the saving to the inhabitants of London by substituting water of equal quality with Loch Katrine in lieu of the hard water of the source from whence the supply is now derived, averaging from 12° to 15° of hardness, would not be less than £400,000 per annum."

This calculation, given to the world by a man of Mr. Bateman's experience and reputation, deserved a great deal more consideration than had ever yet been bestowed on it. Take the quality of the water which it had been proposed to bring from Wales to London, and which had now been carefully tested under many varying conditions. The average hardness was from 2° to 3°; while the hardness of the existing London supply was from 14° to 15°. In considering any additional supply of water for London, the increase of population (say) for the next forty years should be taken into account; and supposing that in 1940 the population of London to be supplied with water was four times as great as that of 1865, the saving by the use of soft water, on the basis of Mr. Bateman's calculation, would be not far short of £1,600,000 annually.

To show the wasteful expenditure of soap caused by the use of hard water, Mr. Verney quoted the following figures from a table drawn up by Professor Church:—

Waters.	Soap Destroyed. Pounds per 10,000 Galls.
Thames	212
Lea	204
Kent Company	265
Manchester	32
Preston	80
Glasgow (Loch Katrine)	4

It was, the author believed, common knowledge among engineers that the deposit formed inside boilers by the use of hard water was a very bad conductor of heat. It followed, therefore, that a large additional amount of fuel was necessary when there was much of this deposit inside a boiler, involving extra expenditure, both for the fuel which was burnt and for labour in removing the deposit at frequent intervals.

Discussion.

Mr. WILLIAM MATTHEWS, M.Inst.C.E. (Southampton), remarked that perhaps the position he occupied had given him opportunities of dealing with water softening to a larger extent than most people. What he particularly wanted to call attention to was that, although the question of the value of softening had been continuously brought forward by chemists and others, engineers themselves had not given the attention to it that they might have done. He thought the reason water softening had not been more largely adopted was because it had been understood that the difficulties and expense were too great. All he wanted to say was that the difficulties were not so great as had been imagined, and that the cost was very much less. He thought that anybody who was inclined to go into the question could rely upon it that they could get water softened efficiently, and with all the advantages of a safeguard against contamination, for the very small cost of ½d. per 1000 gallons.

Mr. CLAYTON BEADLE (Sidcup) differed from the author as to some of the conclusions he had arrived at, and remarked that the amount of soap consumed per 10,000 gallons of water was somewhat misleading. He thought the figure given in the table for Loch Katrine water was very low, and that it should be at least 14 lbs. per 10,000 gallons, instead of 4 lbs. as stated. He took it that this was a matter of calculation, and not of tests.

This concluded the business of the Conference.

REGISTER OF PATENTS.

Gas Water-Heater and Calorimeter.—Simmance, J. F., and Abady, J., of Westminster. No. 21,465; Nov. 27, 1900.

In this apparatus to heat water for calorimetric or other purposes by liquid or gaseous fuel, there is a cylinder enclosing a circular combustion-products tube, and concentrically therewith annular water-chambers and combustion-products passages (extending from end to end of the cylinder) alternately. The water-chambers are practically parallel, and of gradually decreasing length—the longest chamber being on the outside.

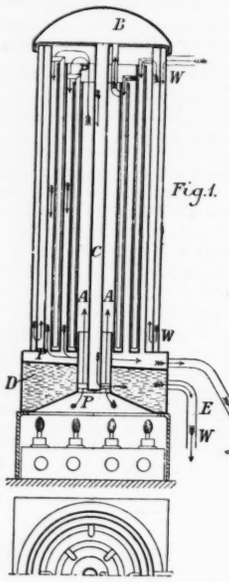


Fig. 1.

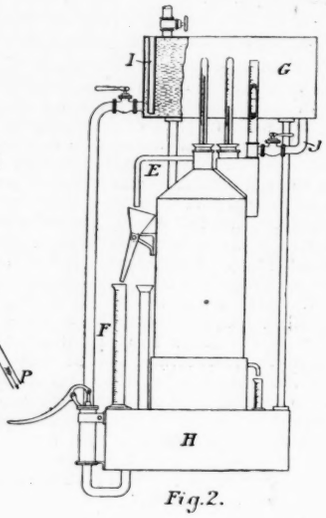


Fig. 2.

Fig. 1 shows the apparatus as arranged for domestic use; fig. 2, the arrangement when employed for calorimetric purposes.

The cold feed-water enters the outer of the three chambers; its course being indicated by the arrows W. This outer annular water-chamber has a middle cylindrical diaphragm so arranged that the cold water traverses the whole length of the outer division before coming in contact with the inner wall of the chamber, and therefore before being heated directly by the combustion products—thus forming a water-jacket to the whole apparatus. From the top of the outer chamber, a series of angled or bent tubes connect it to the next water-chamber; these tubes passing from the top of the former to the bottom of the latter, either through the intervening combustion-products space or through the length of the second water-chamber—in the latter case, reaching nearly to the bottom of it. The water connections between each pair of adjacent chambers are made in the same way; and thus the passing of the water down each series of connecting-tubes, then up each chamber filling it from the bottom, and so on, presents a large heating surface. When the water fills the inner annular chamber (of which the central combustion-product tube A forms the inner wall), it finds a passage through tubes taken from the top of the inner chamber into a circular cover-chamber B, which surmounts the entire series of water-chambers and combustion-products space, but is raised sufficiently to permit free communication between the interior combustion-products spaces and the central combustion-products tube A. A water-conduit pipe C leads down the middle of the central combustion-products tube, and then by short pipes into an annular reservoir D immediately over the burner (but not interfering with the passage of the combustion products). From the reservoir, a pipe E passing through the exterior of the apparatus secures the discharge of the hot water.

When used for calorimetric purposes, the hot-water outlet-pipe E is led off from the upper cover-chamber; and below the mouth of the pipe is placed a swinging funnel, so arranged that it delivers the heated water in either of two directions—to a waste tank near the base of the apparatus or to a measuring flask F. The stream of out-flowing water may be directed to the measuring flask during the time occupied by the experiment, and then immediately turned to waste; the swinging funnel being so arranged that it remains steady in either of the two positions. During the same time the quantity of gas consumed is noted. The cold water inlet-pipe and the hot water discharge-pipe are each arranged with a thermometer placed in such a position as to be conveniently read. Thus a knowledge of the quantity of gas used, the quantity of water heated by it, and the rise in temperature of the water, gives information as to the calorific value of the fuel used.

In order to have the temperatures of the cold water at the inlet and the hot water at the outlet steady, the flow of water through the apparatus must be steady. To ensure this, and to increase the portability of the apparatus, a cistern G is mounted on a stand above the level of the cold-water inlet to the heating apparatus. The heated water, when running to waste, flows into the waste tank H, and a hand-pump is provided to force the water into the cistern G. The cistern is air-tight, but has a vent-cock at the top; and an air-tube I runs from the top cover down within the cistern to a short distance above the outlet pipe J, through which the water flows into the heating apparatus. To fill the cistern, the vent-cock is opened, and the pump put in action, raising the water from the waste-tank and filling the cistern till it ultimately overflows at the top of the air-tube I. The water is then allowed to run from the cistern into the heating apparatus. The first immediate effect is that the water sinks in the air-tube, and the hydraulic head is always the same as if the water in the cistern were filled up to the level of the bottom of the air-tube.

Prepayment Gas-Meters.—Cowan, W., of Edinburgh. No. 23,248; Dec. 19, 1900.

The first part of this invention consists in an improved form of coin-pocket having a retaining device adapted to prevent the rotation of the pocket in the forward direction, except when a coin is present in the pocket. This part is applicable to all types of varying mechanism. The second part of the invention consists in mounting a price-varying scale on the same shaft as the moveable member of the price-varying platform described in patent No. 18,727 of 1899—the pointer being attached to a pawl, which locks the price-varying scale in position.

Fig. 1 is a front elevation of a meter prepayment mechanism, in which the price-variation is accomplished by change-wheels, and to which the improved coin-pocket is applied. Fig. 2 is a plan of the

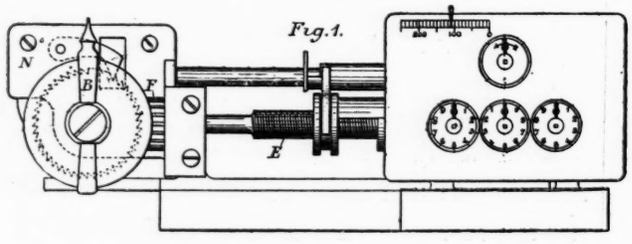


Fig. 1.

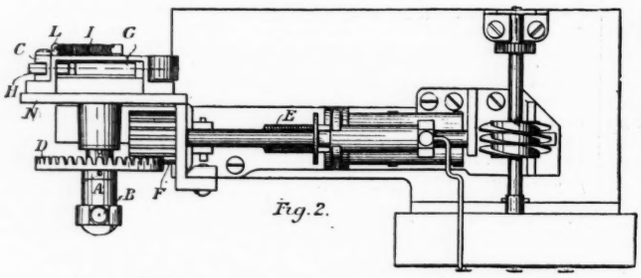


Fig. 2.

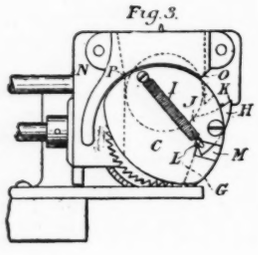


Fig. 3.

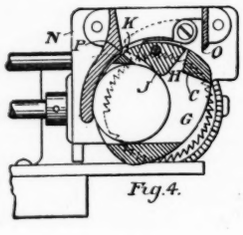
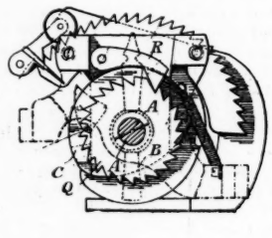


Fig. 4.



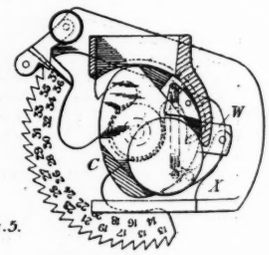
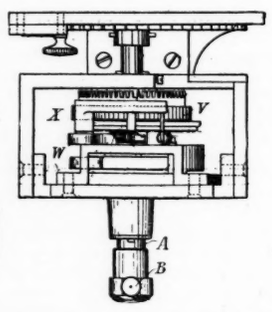
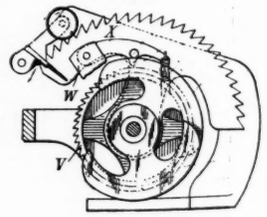


Fig. 5.





mechanism. Fig. 3 is an elevation of the pocket, looking on the reverse side of fig. 1. Fig. 4 is a sectional elevation of the pocket. Fig. 5 is a plan illustrating the application of the improved coin-pocket to meter prepayment mechanism like that described in the patent of 1899; also three sections.

Referring to figs. 1 to 4, there is a shaft A fitted with a handle B to operate it from outside the meter. Upon the shaft the coin-receiver C is fitted, and a removeable crown-wheel D. The latter can be changed when a change in the price of gas is to be made; and it gears directly with one of the screw members E of the usual type of screw nut gas

measuring-out devices, by means of a pinion F—made of sufficient length to gear with the different sized crown-wheels employed for effecting the price variation. The coin-receiver is of disc form, and has a through passage G cut in it; the plane of the passage being at right angles to the shaft. This passage is made of such width as to allow coins smaller than the one for which it is intended to pass freely through it. The disc is slotted out at one side to receive a two-armed pawl or lever H, which pivots on the disc, and is normally held by a spring I with one arm J projecting into the coin-passage, and its other arm K projecting beyond the circumference of the disc (as seen in fig. 3); the spring being attached to a pin L fixed on the lever and resting against an abutment formed by the extremity of a recess M in the disc.

When a coin is inserted, and it is attempted to rotate the handle in the forward or positive direction, the coin engages with the inner end of the pawl H; while the opposite part of the circumference of the coin simultaneously comes into contact with the edge P (figs. 3 and 4) of the coin-shoot. On rotating the disc, the coin must pass under the roof, thus causing the projecting arm or tooth of the lever to be withdrawn within the circumference of the disc, and enabling a complete rotation to be made. During the rotation of the coin-receiver disc, and when the coin has passed the lower extremity of the roof extension, it drops out of the pocket, thus freeing the pawl H, which again assumes the position in which it will catch the edge O of the coin-shoot, and prevent a second rotation until another coin has been inserted into the coin-receiver. Backward rotation of the disc C is prevented in the usual way by a ratchet-wheel and pawl. The ratchet-wheel has a portion of its circumference uncut, to allow the coin-receiver some freedom of movement at the point where the coin is inserted; so that the passage G may be brought into register with the fixed coin-shoot.

Referring now to fig. 5, the coin-receiver C is mounted on the same axis as the measuring-out ratchet-wheel V, and has attached to it an arm W, which carries a pivotally mounted pawl X. This pawl is held forward by a spring attached to the side of the coin-receiver; and it is fitted with a pin by means of which the tooth shown is kept out of engagement with the measuring-out wheel when travelling round the portion of the wheel covered by the measuring-out platforms of the price-varying device. The ratchet-wheel Q, which the pawl R engages for preventing backward rotation of the handle B, should have the pitch of its teeth so proportioned as to prevent "pumping"—that is, turning the measuring wheel by working the ratchet-wheel backwards and forwards in the space of a tooth, during the measuring-out portion of the forward travel of the handle, when the pawl tooth is in engagement with the teeth of the measuring wheel.

The scale of the price-varying device is in the form of a segment, which is attached to the outer extremity of a shaft upon which the measuring-out wheel and the fixed platform of the price-varying device are sleeved. The moveable platform is secured to the inner extremity of a shaft axial with, and forming a bearing for, one end of the coin-pocket shaft A. The periphery of the segmental scale is provided with ratchet teeth, into which drops the tooth of a pawl pivoted on the fixed frame of the mechanism. The free extremity of this pawl is drilled to receive a screw, by means of which the pawl may be fixed to the frame for locking the scale in any desired position. In order to indicate the quantity of gas to be supplied in exchange for a coin, there are figures on the ratchet-segment, arranged in two circles one within the other—every alternate figure being situated on the circumference of the inner circle. This diminishes the length of the segmental scale required for a given range of price variation.

Locking Device for Gas-Taps.—Newbigging, E. L., of Macclesfield. No. 7206; April 6, 1901.

This is a device whereby taps may be locked in order to prevent unauthorized use of gas. It is intended to be applied to the cocks when they are fixed in their working positions.

A clamp is made (preferably of iron or steel) of such a shape that the cock can be enclosed within it—the shape of the clamp being varied to

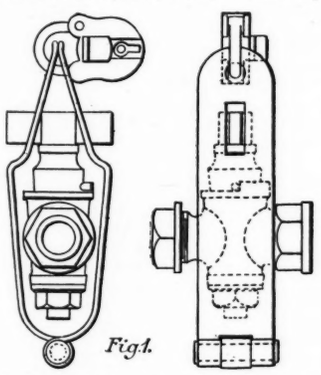


Fig. 1.

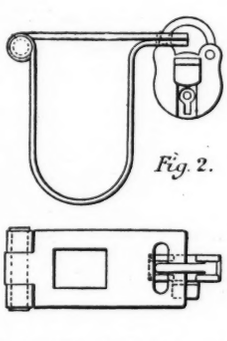


Fig. 2.

suit the particular type of cock to be locked. Thus fig. 1 shows the form adopted when the cock is fitted with a T-shaped head, while fig. 2 shows the clamp used when the plug is formed with a square nipple or head. The clamp is made in two parts hinged together—with a T-shaped head, at the bottom; while, if it has a square-headed plug, the clamp is made U-shaped, with the hinge at one end of the U. When the clamps are in position and closed, a padlock bow is passed through holes formed in the two portions of the clamp; and the plugs cannot then be turned until the clamp is removed.

Manufacture of Illuminating Gas and Coke.—Ruppert, O., of Essen-Ruhr, Germany. No. 18,513; Sept. 16, 1901.

In the manufacture of illuminating gas, says the patentee, it has long since been ascertained by experience that when the value of the illuminating gas is raised, that of the coke is reduced, and that, on the other hand, when the value of the coke is raised, that of the illuminating gas is reduced. This interdependence between the qualities of the coke and the illuminating gas is not, however, the only cause of unsatisfactory and uneconomical results from the distillation of coal in the manufacture of illuminating gas. On the contrary, when the distillation is conducted in ordinary retorts, the coke produced is frequently of very little value, as it is spongy, broken into small pieces, and easily crumbled—causing considerable waste; while the illuminating gas produced is not of correspondingly good quality, as the gases are completely driven out of the coal, so that gas rich in illuminating substances is mixed with gas poor in illuminating substances, which renders the luminosity of the resulting mixture poor. It has been attempted to obviate this difficulty by discontinuing the process of distillation before the gases have been completely driven out of the coal; but this has resulted in a worse quality of coke.

The present invention has for its object to obviate the disadvantages named, and simultaneously to increase both the value of the coke and that of the illuminating gas. In ordinary horizontal retorts as hitherto used, the coal has been coked in a thin layer; and to this fact may probably be ascribed (the inventor points out) the low value of the coke produced, since the weight upon the coal is not sufficient to prevent it from swelling in the heat, or from being split by the gases generated. For this reason, only coal very rich in gas has been used in retorts as heretofore constructed; coal poor in gas being considered unsuitable for working retorts for illuminating gas. For the purpose of obviating the disadvantage due to the shallowness of the layers, he increases the density of the coal during coking by the weight of the charge; so that swelling, and the formation of spongy pieces of coke, are prevented. For the purpose of obviating the second disadvantage, and of making the quality of illuminating gas independent of that of the coke, he closes the pipe to the condenser when the generation of poor gas begins, so that the rich gas cannot become mixed with the poor. The poor gas can, of course, as heretofore, be used (say) for heating.

In order to make the coal so dense by the weight of the charge that swelling and the formation of spongy pieces of coke are prevented, a retort-furnace with tall vertical distilling chambers or retorts is used. In order to remove the poor gases from these chambers at the proper times, they are arranged to discharge into a common distributing chamber through openings which can be closed by slides. To enable these gases to be used for heating the retorts, passages for heating the retorts communicate with the distributing chamber.

It is said to be advantageous to connect only a portion of the heating passages with the distributing chamber, so that the poorer gases need not be burnt immediately after their production, but may be first mixed with producer gas, and, if necessary, with a supply of air. For this purpose, the heating passages in the walls are divided into two sets—one serving to receive the producer gas, and the other for conducting the poor gases into a bottom passage, and there mixing them with the producer gas, and it may be also with air, in order that they may then be led to the first-mentioned set ready to be consumed. The distributing chamber therefore covers only the set of heating passages that is used for receiving the poor gases.

The use of tall vertical chambers, coupled with the formation of compartments separated from one another, and the use of these compartments as heating passages, necessitates the employment of bricks of special forms; and joints in the interior of the retorts are, as far as possible, avoided. The wall lying between two retorts is consequently formed like a set of retorts, so as to provide both a high wall between the chambers and also several heating compartments or passages; while the retorts themselves resemble heating chambers in shape. By this means, the durability of the walls of the retorts is increased; and at the same time an arrangement is provided which facilitates the formation of gas-tight heating compartments. The heating walls are consequently, as far as practicable, made of single vertical hollow bricks, in each of which the cavity forms a heating passage, while one pair of opposite walls constitutes walls of two adjacent retorts, and the other pair of opposite walls of brick forms the connecting or dividing walls of two heating passages.

An example of apparatus in accordance with this invention is shown on the next page. Fig. 1 is a longitudinal section of the retort chamber. Fig. 2 is a horizontal section. Figs. 3 and 4 are longitudinal sections. Figs. 5 to 7 show the construction of the walls of the retorts and the heating passages in the walls.

The tall vertical retorts shown are connected together in groups of four by protecting arches; while there are passages through which the retorts are charged from above. The retorts are provided at their upper ends with openings communicating with a common distributing chamber, with which a set of heating passages in the walls also communicate. The heating passages in the walls (fig. 2) are arranged side by side in the direction of the length of the retorts. The passages (which are side by side) between two adjacent retorts are connected together to form one set of heating passages; and the passages (which are one behind another) of various chambers are connected together to form the other set of heating passages. The set composed of the former passages is covered by a distributing chamber only for the purpose of receiving the gases poor in illuminating substances flowing from the retorts, and of causing them to be led to the bottom passages into which gases flowing from a suitable source (as the producer) enter through the openings shown. Air can be mixed with these gases by means of lateral pipes. The poor gas, together with the gas generated in the producer, passes through the second set of passages, and through a chamber formed by the protecting arch, into lateral discharge passages, and can then be conducted into passages so as to heat the air-pipe.

As will be seen from figs. 5, 6, and 7, the walls of the retorts are composed of hollow bricks arranged close together and forming retort-like passages. The cavities of these bricks form the passages referred to; while of each brick one pair of the walls located opposite to each other forms the walls of two adjacent retorts, and the other pair the communicating or separating walls of two adjacent passages. As will be seen from fig. 5, these several heating passages are advantageously made of a single brick, so that there are no joints between the retorts and the heating passages in the walls. If the great height of the retorts

Fig. 1.

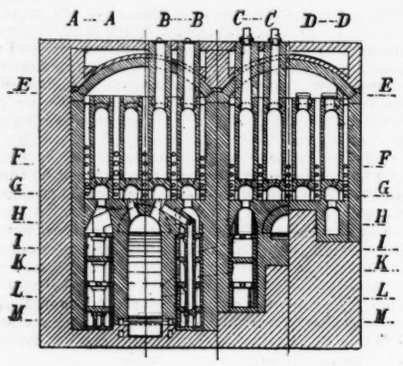


Fig. 2.

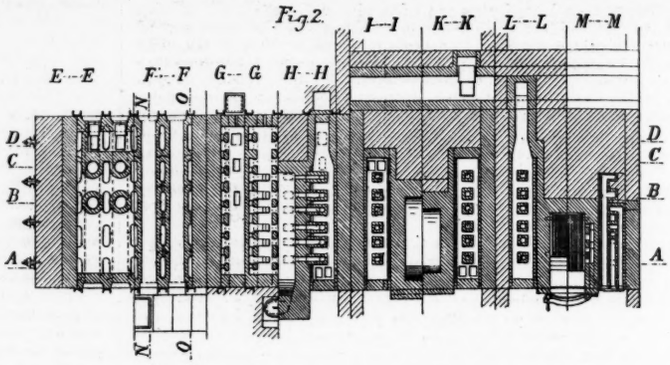


Fig. 3. N--N

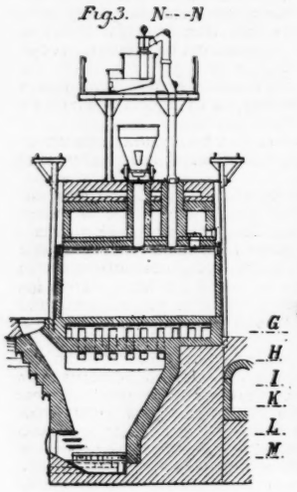


Fig. 4. O--O

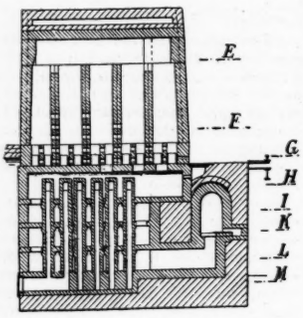


Fig. 5.

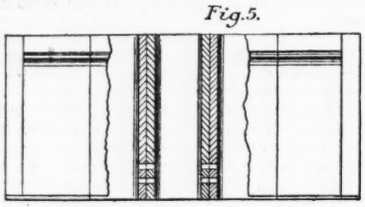


Fig. 7.

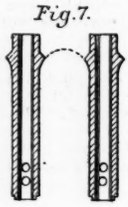


Fig. 6.

should not permit them each to be made from a single brick, the number of joints is reduced to a minimum by the form of the bricks. The retorts are closed front and rear by doors provided with charging openings.

The operation of the apparatus is as follows: The coal is introduced into the retorts either through the top charging openings from coal-waggons above, and is then levelled and rolled, or else is forced or thrown in through the small upper charging openings in the side-doors of the chambers, or from the side when the doors are open. When the coal has been introduced, the covers of the charging-openings and the side-doors are tightly closed. The hot gases from the producer flow into the bottom passages, and thence into the heating passages in the walls—mixed, it may be, with hot air supplied to the bottom passages. At the beginning of the gasifying of the coal, the openings remain closed by the slides, and all the rich gases are drawn away in the ordinary manner by means of an exhauster through the upright pipes to the condenser, and are purified as usual in coolers and washers, and conducted away to the place where they are to be used. When, towards the end of the gasifying period, the gases decrease in illuminating power, the communication between the upright pipes and the condenser is closed, and the slides are withdrawn from the openings, so that the poorer non-luminous remainder of the gases from the coal passes into the distributing chamber above the retorts, and thence through the heating passages to the bottom chambers, into which the gas flowing from the producer also enters. The poor gases, together with the producer gas, then flow through the second set of passages, and then through the corresponding chamber formed by the protecting arch into the lateral discharging passages, and are then conducted away to be used for heating the air-pipe.

APPLICATIONS FOR LETTERS PATENT.

23,242.—Steane, M. P. A., "Incandescent gas and oil burners." Nov. 18.

23,272.—Mills, B. J. B., "Liquid meter." A communication from S. Bouchet. Nov. 18.

23,277-8.—Koppers, H., "Coke-ovens." Nov. 18.

23,325.—Scott-Snell, C., "Lamps for use under pressure." Nov. 18.

23,449.—Bowman, D. W., "Gas generator and burner." Nov. 19.

23,458-9.—Kitson, A., "Vapour-burning apparatus." Nov. 19.

23,467.—White, H., "Gas-fires." Nov. 20.

23,480.—Boyde, D., "Preventing escape of gas from incandescent gas-lights when the bye-pass is burning." Nov. 20.

23,533.—Hohoff, G., "Photometer." A communication from D. Hoffsümmer. Nov. 20.

23,543.—Losfeld, D., "Generating acetylene gas." Nov. 20.

23,596.—Millar, T., "Adapting gas-brackets to carry incandescent burners." Nov. 21.

23,672.—Rasch, F. J. G. L., "Gas-stoves." Nov. 21.

23,689.—Hamilton, J. H., "Internal combustion engines." Nov. 22.

23,732.—Sugg, W. T., "Outdoor incandescent gas lighting." Nov. 22.

23,733.—Sugg, W. T., "Production of surfaces for use in incandescent gas lighting." Nov. 22.

23,737.—Murray, W. T., "Casings for street cocks for water, gas, and the like." Nov. 22.

23,855.—Blakey, J. W., "Anti-vibration devices for incandescent gas-burners." Nov. 25.

23,860.—Sprott, R. E., "Spray carburetters for internal combustion engines." Nov. 25.

23,866.—Sinclair, J. A., "Automatically lighting or extinguishing gas-jets at stated periods." Nov. 25.

23,874.—Potter, W. G., "Gas-governor." Nov. 25.

23,876.—Potter, W. G., "Gas-burners." Nov. 25.

23,908.—Sprott, E. W., "Gas purification." Nov. 25.

23,981.—Wellington, H., "Street lamp-posts." Nov. 26.

23,984.—Crastin, C., "Gas lighting by incandescence." Nov. 26.

23,987.—Zimmer, G. F., "Conveyors." Nov. 26.

23,991.—Austin, A. T., "Incandescent gas-burners." Nov. 26.

24,030.—Heaton, J., and Worthley, N. T., "Acetylene generating apparatus." Nov. 26.

24,046.—Childs, J. G., "Elevators and conveyors." Nov. 26.

24,085.—Gilmour, R., "Incandescent gas-burners." Nov. 27.

24,109.—Winn, P., "Suspension gas-lamps." Nov. 27.

24,120.—Grimsley, J. G., "Utilizing hot water generated by gas and oil engines." Nov. 27.

24,137.—Thomas, P., and Shaw, C. J., "Gas-pendants." Nov. 27.

24,150.—Spooner, A. F., "Charging and discharging furnaces and the like. A communication from J. B. F. Loubriat. Nov. 27.

24,176.—Koppell, R. H., "Explosion engines." Nov. 28.

24,218.—Muller, J. L., and Bonnet, J., "Manufacture of incandescent mantles." Nov. 28.

24,263.—Wagner, J., "Power gas from liquid fuel." Nov. 29.

24,279.—Hood, J., "Steadying suspended gas-pipes and the like." Nov. 29.

24,287.—Cowell, W. B., "Water or producer gas." Nov. 29.

24,291.—Rowbotham, W. & K. A., "Explosion engines." Nov. 29.

24,312.—Stubbers, J., "Gas-generators." Nov. 29.

24,343.—Aird, K., "Atmospheric gas-burners." Nov. 29.

24,386.—Sutton, A. E., "Incandescent gas lighting." Nov. 30.

24,392.—Street, S., "Unions for gas-pipes and the like." Nov. 30.

24,416.—Christie, B. B., "Gas stoves or furnaces." Nov. 30.

Omagh Gas-Works Purchase.—At a public meeting recently held at Omagh to consider the question of the purchase of the gas-works by the Urban District Council, objection was taken to the proposal on the ground that the present condition of the finances of the town did not warrant it. One speaker quoted extracts from a recent speech of the Chairman (Mr. M'Lynch) showing that it had been stated that they had £1100 in hand to meet the expenses of the opposition to the Gas Bill, whereas the Council were in debt to both the County and the Rural Council. If matters went on as they were going at present, there would be an extra rate of 7s. 8d. in the pound. Another speaker submitted figures to show that in a short time the town would be in debt to the extent of £4541. The motion to proceed with the purchase was carried; but a poll is to be taken.

Income-Tax on Gas Profits at Manchester.—At the meeting of the Manchester City Council last Wednesday, the Chairman of the Gas Committee (Alderman Gibson) reported that, under the direction of the Deputy-Superintendent, a claim had been successfully made to the Commissioners for the repayment of income-tax in respect of the gas profits for the year ended March 31 last, under a special provision of the Income-Tax Acts; and the sum of £417 12s. had been recovered and placed to the credit of the profit and loss account of the department. This was in addition to sums of £206 17s. 7d. and £1175 2s. recovered in previous years. The Deputy Superintendent obtained information how to proceed in this matter from Mr. Adam Murray, an ex-member of the Council; and it was therefore really through Mr. Murray that he had been able to secure the repayment.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Manchester District Gas Engineers and the Wakefield Inclined Retorts.

SIR,—After reading the discussion upon the above question published in the last issue of the "JOURNAL," I must say that one has considerable sympathy with the remarks contained in your Editorial note. It is certainly lamentable that the profession of gas engineering should be such an inexact science as to make it apparently impossible for its professors to discover the relative merits of two distinct systems of carbonizing—the vital operations they are conducting day by day.

In order to further the object you suggest, I shall be very pleased to render any assistance in my power; and with this object in view, I will undertake to bring the question before the notice of the members of the Institution of Gas Engineers at their next annual meeting, when I will propose that a Committee be appointed, and that the Gas Institute be also invited to nominate a similar number of gentlemen, to sit jointly as a Committee to determine the basis upon which comparisons as to the relative merits of present-day carbonizing methods should be determined, and with powers to glean information from every source they can, in order, if possible, to submit a comparative statement—not necessarily publishing the names of the towns in question.

Such a Committee would, I am sure, be able to bring out a lot of very valuable information; and it appears to me that the prime factor of any such comparisons must be tons of coal per man per hour actually worked, rather than the mere cost. These, however, are points that can well be left to the proposed Committee to deal with.

W. R. HERRING.

Edinburgh, Dec. 5, 1901.

SIR,—Since making my remarks on Mr. Townsend's paper at the meeting of the Manchester District Institution of Gas Engineers last Saturday, it occurs to me to point out that there is very little difference between the various speakers in the cost of wages per ton of coal carbonized, when comparisons are carefully made. For instance, Mr. Bromley's cost is 1s. 10d., as against my 2s. for the same work, which includes all carbonizing wages. Then, again, Mr. Townsend's cost for stoking only—no coal or coke handling—is 1s. 3d., Mr. Bromley's 1s. 4d., and mine 1s. 4d.; all for the same work done. So that where the conflicting statements come in, I fail to see. If we could work three or six or nine, &c., beds all the year round, this cost would probably be 1s. per ton. My experience teaches me that horizontal hand-charged retorts are not in it with inclines for economy and easier work for the men. As I have had no directly practical experience with the working results obtained by stoking machinery, I cannot make comparisons; but I do not think there is any difference worth mentioning between inclines and machinery, so far as first cost and upkeep are concerned.

TIM DUXBURY.

Middleton, Dec. 5, 1901.

P.S.—In the discussion, I am reported to have said that "with inclined retorts, if they could use them *with* cannel, they would get by far the best results." This should read "*without* cannel," as my remarks afterwards go to show.

Inclined v. Horizontal Retorts with Machinery in Large Works.

SIR,—There is no doubt that the case for inclined retorts rests upon a more stable foundation than is afforded by the figures which Mr. Herring puts forward in its support. Mr. Herring correctly quotes "Field's Analysis" in giving the Brentford carbonizing wages per 1000 cubic feet sold for 1891 as 5·32d. But I think he has forgotten Mr. Husband's paper upon "Inclined Retorts" read before the Institution of Gas Engineers as lately as 1895. I quote Mr. Husband's words in his reply to the discussion ("Proceedings," p. 206): "In reference to the heavy cost of carbonizing at Brentford, I may as well tell you that the figures have been mixed up rather in 'Field's Analysis.' The yard work, and all that sort of thing, has been put down to carbonizing; and if a man went outside to stack pipes in the yard, that has been put down to carbonizing. The next report you will see will be very different."

Nor do I think Mr. Herring has sufficiently *simmered* his Field for 1900. He quite correctly quotes therefrom the carbonizing wages per 1000 cubic feet for 1900 as 2·17d. But what about the water gas? The same compilation gives the Brentford consumption of oil for its manufacture as 1,700,237 gallons. Assuming 4 gallons of oil per 1000 cubic feet would give 425,059,000 cubic feet of water gas; and taking manufacturing wages at 1½d. per 1000 cubic feet would give £2656. These amounts must therefore be respectively deducted from the items given in "Field's Analysis," when they will stand corrected as follows:—

Total carbonizing wages, £15,638, less for water gas £2656 = £12,982 for coal gas only.

Total gas sold, 1,732,482,000 cubic feet, less water gas 425,059,000 feet = 1,307,423,000 feet coal gas only.

£12,982 divided by 1,307,423 = 2·38d. carbonizing wages per 1000 cubic feet coal gas only.

With regard to the figures which have been given by Mr. Tysoe as to machinery costs at the East Greenwich works, I should like to point out that these are strictly comparable ones. Some of our stations work two shifts, some three shifts, and one two shifts in winter and three shifts in summer. But the wages paid are in all cases in exact proportion to the work performed.

CHARLES CARPENTER.

Dec. 9, 1901.

SIR,—In his anxiety to convert all gas engineers to his own ideas, Mr. Herring is scarcely consistent in his reasonings.

Referring to gaseous firing, he says that if there were only one bench of horizontal retorts successfully fired on the regenerative principle, he would not care if there were a hundred failures. It would simply prove that the system was right, and the blame of the failures lay on those who carried out the unsuccessful applications.

Then he takes the figures from various works which would seem to prove that there is little benefit in using stoking machinery, but would brush aside the figures relating to Glasgow and East Greenwich. Speaking of the wear and tear, he says the elevators and conveyors are common to both systems. Then, again, it would not be satisfactory to leave those out of the count when comparing the economical advantages of the two systems.

Mr. Tysoe can well be left to take care of the East Greenwich facts and figures; but I would like to deal with some of Mr. Herring's remarks anent Glasgow. In his reply to "Scot" in your issue of the 19th ult., Mr. Herring says he prefers to take the figures for the cost of carbonizing by the Arrol-Foulis machinery from the published results of Glasgow in "Field's Analysis." In your issue of this week, he says these results are to be left out of consideration. Why? I do not know Mr. Herring's reasons; but, for my part, I think they should be left out, as they do not put the case for machinery nearly strong enough—seeing that they include the returns from works which are only partially equipped with machinery, and also works which still have to use hand-stoking.

No doubt, with the exception of Brentford and Huddersfield so often quoted, the returns given for other undertakings are modified in a similar manner.

To show that the figures quoted for Glasgow are of little use for the comparison under discussion, I may mention that the total wages at present paid in all the departments in the works at Dawsholm—including the office staff—do not exceed the figures taken by Mr. Herring as the cost of carbonizing by the Arrol-Foulis machinery.

To get at the economical advantages of either system, the costs which bear on the differences of each system should only be considered. When these are arrived at, engineers will be able to apply them to their own circumstances, and judge which system will be most suitable for their respective conditions.

Although Mr. Herring would fain be the sole judge of what figures, &c., should be used in the comparison under notice (patting those on the back who supply details in support of his ideas, and cudgelling those who differ from him), still, for the purpose of getting at bottom-facts, I venture to give the following details of the work done on the retorts heated by gas from outside producers at Dawsholm.

Details.

4 Outside producers.
8 Double ovens.
12 Retorts in each oven. Retorts 9-feet long.
192 Mouthpieces.
4 Hour charges.
48 Mouthpieces charged or drawn per machine per hour.
1152 Mouthpieces charged or drawn per machine per twenty-four hours.
17 Cwt. of coal carbonized per mouthpiece per twenty-four hours.
163 Tons carbonized in bench per twenty-four hours. The men work eight-hour shifts.

Men Employed at Ovens.

1 Drawing-machine man.
1 Charging-machine man.
1 Door-closer.
1 Door-opener; also keeps lids clean.
1 Pipeman.
Wages per shift, £1 6s.
Wages per twenty-four hours, £3 18s.

$$\frac{£3\ 18s.}{163} = 5{\cdot}74d.\ \text{per ton.}$$

Men Employed Filling and Cleaning Producers.

1 Fireman and 1 ashman.
Wages per shift, 10s.
Wages per twenty-four hours, £1 10s.

$$\frac{£1\ 10s.}{163} = 2{\cdot}21d.\ \text{per ton.}$$

On the twelve retort-ovens with ordinary producers, the machines are doing equal work; but the wages for firemen are higher.

It may be noted that the length of the retorts, 9 feet, was the standard length for shovel-charging. Retorts 10 feet or longer can be as easily charged by the same number of men.

Mr. Herring claims for inclines a gain in the area of ground occupied for a given carbonizing unit. His figures of 24 ft. by 17 ft. 2 in. for 37 tons for twenty-four hours, work out to 11·1 feet super per ton. Each twelve-retort oven bench at Dawsholm (including chimney and abutments) covers an area of 88 ft. by 18 ft. 2 in., for 163 tons per twenty-four hours. This works out at 9·8 feet super per ton.

There are other points in this matter well worthy of discussion; but I think most engineers are quite able, and entitled, to form their own opinions—especially when backed by experience.

Mr. Herring will find that the innings for horizontal retorts and machinery is not yet closed. There are better scores yet to be made.

A. WILSON.

Dawsholm, Dec. 5, 1901.

SIR,—I have read with considerable interest Mr. Herring's letter in this week's "JOURNAL;" also his second article on the "Economical Advantages of Inclined Retort Settings." I am quite of the same opinion as Mr. Herring—that the desire which has been shown in some quarters to restrict the comparison of carbonizing costs to a portion only of the entire operations, does not conduce to the accurate gleaning of the whole of the facts connected with this question; including as it does, in my opinion, not only the questions of carbonizing costs, upkeep, and capital charges, but also the effect of the system upon carbonizing results

I cannot agree with Mr. Herring that satisfactory answers to my questions as to wear and tear, the make of gas, &c., have been offered five and seven years ago. I have been trying to obtain satisfactory answers to these questions during the last two or three years, but have not yet got them; and if I wanted further evidence that they are not yet to be had, I have only to point to the discussion at Wakefield, on

Nov. 30, where men of large and varied experience were conscientiously seeking for truth.

It is because of my possession of knowledge of modern inclined-retort installations (which I am constantly brushing up) that has made me decide that I cannot recommend their adoption here. I am quite convinced that those who claim improved results from the same class of coals carbonized in inclined retorts have only had experience of poor results in their horizontal settings, and that there are not many instances where the adoption of inclined retorts can be justified. But I think that Wakefield must have been one of these. Mr. Townsend has, however, too much good sense to attribute his improved results to the system.

I prefer to have retorts set in such a manner that they will stay where we put them, maintain a true alignment throughout a long working life, and provide us with free scope—by the aid of suitable retort-house machinery—to carbonize to the best advantage the cheapest class of gas-making material, whatever form or condition it may be in. The solid advantages of such an installation of carbonizing plant by far transcends any advantage which can be properly claimed by the inclined system.

I am grateful to Mr. Herring for his anxiety about the condition of the horse I am backing; but I have no fear. I will not only back it, but ride it myself, and undertake to be at the winning-post at the right time—having left far behind some of the present-day hobby-horses ridden to death.

St. Helens, Dec. 6, 1901. SAMUEL GLOVER.

Retort Ascension-Pipes.

SIR,—At the Manchester District Institution of Gas Engineers meeting, recorded in your last issue, Mr. J. W. Morrison, of Sheffield, was good enough to contribute some further information respecting the desirability of having one ascension-pipe only to a 20-feet horizontal retort. He said he had experimented with only one pipe, and found the result satisfactory. Mr. Carr, of Stalybridge, demurred to the suggestion, and said he fancied "Mr. Harman thought he had made a discovery when he published his letters about having only one ascension-pipe;" and he proceeded to point out that the late Mr. Evans, when starting the Beckton works, tried one ascension-pipe to each retort, but eventually resorted to two—one at each end.

Permit me to at once disclaim any "fancy" respecting my having made a discovery upon the subject. In my first letter—*vide* "JOURNAL," Vol. LXXVI., p 1524, December, 1900—the problem I desired solving was as follows: "If only one ascension-pipe is required in the case of inclined retorts, and that nearly always placed at the lower end, why is it necessary to have two ascension-pipes to horizontal retorts of the same section and length?" Subsequently you published a further letter from me—*vide* "JOURNAL," Vol. LXXVII., p. 279, at the commencement of the present year, which summarized the various replies and information from different correspondents thereon.

It is unnecessary to recapitulate the satisfactory experiences recorded by those who had tried the single ascension-pipe. The contribution by Mr. Morrison to the same subject—to the effect that he has found one ascension-pipe per retort advantageous—is worth a great deal, as he has had such an extended and enormous experience with both the horizontal and inclined systems.

Assuming for a moment one ascension-pipe being equally applicable to a retort, whether built on the horizontal or on the slope, it seems late in the day for another member at the before-mentioned meeting to claim for inclined retorts that a large economy was effected, because only one ascension-pipe, one hydraulic main, one set of valves, and one foul main were necessary; while in horizontals of the same section and length, they had two sets of these in use, which he argued doubled the expenditure in ironwork.

The same speaker stated that a setting of inclined retorts cost rather more than horizontals; but that it was only a little more, on account of the saving obtained by the reduction of the ironwork, through only one set being required.

The numerous inquiries appearing in your columns as to the difference in cost between the inclined and horizontal systems will doubtless be the means of producing most valuable information thereon.

Huddersfield, Dec. 7, 1901. EDWARD A. HARMAN.

Main-Tap Fasteners.

SIR,—I observe that Mr. E. L. Newbigging has taken out a patent for main-tap fasteners. It may interest your readers to know that, feeling the need of some such device, I designed a similar article over twelve months ago for use in Belfast. We have now more than 700 on our "off" meters, and have been using them regularly for the past year. I enclose a main tap, clip, and lock for your inspection. The clips are made in our own shops; the combined cost of lock and clip being less than 1s. each.

Belfast, Dec. 5, 1901. A. M'L. CLELAND.

Sale of the Airedale Gas-Works to Bradford.—The terms agreed upon between the Directors of the Airedale Gas Company and the Bradford Corporation for the sale of the undertaking of the former to the latter Authority were approved at a meeting of shareholders held at Idle last Thursday.

Newhaven and Seaford Water Company.—In the report which was submitted at the recent meeting of the Company, the Directors stated that the revenue account showed a profit for the year ending Sept. 29 of £2135, and that the balance available for division was £1799. Out of this, a dividend was recommended at the rate of 3 per cent. per annum on the original capital, and £2 2s. per cent. on the additional capital, both free of income-tax. This would absorb £1025. It was also proposed to place £403 (the balance of the parliamentary and law costs incurred in obtaining the new Act) to the suspense account, and £200 to reserve; leaving a balance of £179 to be carried forward. The report was adopted.

LEGAL INTELLIGENCE.

MARYLEBONE COUNTY COURT.

Friday, Dec. 6.

(*Before His Honour Judge* STONOR, *and a Jury.*)

Liability for Damage Caused by a Burst Water-Main.

In this case, Mr. J. Beesley, a plumber, of 42, Homer Street, Marylebone, brought an action against the West Middlesex Water Company to recover damages for loss alleged to have been sustained by him through the bursting of one of their mains.

Mr. G. F. EMERY appeared for the plaintiff; Mr. J. CRAIG represented the defendants.

Plaintiff stated that he held his house and premises under a repairing lease, and in August last had opened up the ground in front for the purpose of putting in a new drain. On the 18th of the month, early in the morning, he noticed that the water came from the taps downstairs very slowly, while upstairs they could get no water at all. His father, who lived two doors off, called, and said he was going to see one of the turncocks about the water. At nine o'clock at night, he (plaintiff) noticed that the opening in the ground was full of water—evidently caused through the main bursting. As a result, a portion of the new brickwork was damaged, and the greater part of the new drain had to be re-laid. He estimated his loss at £15, without including the inconvenience he suffered.

In cross-examination, he said he saw nothing wrong in the morning. The water came along an old disused drain from where the pipe had burst to the trench on his premises.

Mr. *E. Beesley*, the plaintiff's father, said he noticed that there was a scarcity of water; and he hurried off to the turncock. The latter was not in; but witness left a message with the turncock's wife that something was wrong with the water.

Mr. CRAIG submitted that his clients laid their mains and carried on their work generally under statutory authority. He referred his Honour to the case of *Fletcher v Rylands* in support of his contention that, where mischief arose from the use of the machinery of a railway company, a water company, or similar concern, and where there was no evidence of negligence, the company were not liable. Of course, if the other side proved negligence on the part of the Company, the latter would be liable; but he submitted that no evidence thereof had been given. The plaintiff did not complain to the Company; and his father merely told the turncock's wife that there was a deficiency of water. No notice as to the bursting of the pipe was given to the Company or their agents. For his learned friend to succeed, he would have to show that such notice had been given. The turncock's wife was not the agent of the Company.

His HONOUR said that apparently the only way in which the plaintiff's evidence might support a case of negligence would be by showing that the main was not a good and proper one.

Mr. CRAIG submitted that no evidence had been given to show that the pipe in question was defective. Everyone knew that, in the nature of things, water-pipes sometimes burst, and it was often impossible to assign a cause for the accident. It was absolutely impossible for water companies to be constantly opening the roads to see that the pipes were in proper order.

Mr. *M. W. Hervey*, M.Inst.C.E., Chief Engineer to the Company, stated that the pipe in question had been down more than 23 years, and they had had no more trouble with it than with similar pipes in other streets. It sometimes happened that, for no assignable reason, such a pipe would burst—in fact, they could scarcely ever trace the cause of such accidents.

Cross-examined: They were constantly having such breaks; and the old pipes did not burst more frequently than the new ones. All their pipes, before being laid, were tested up to 300 feet pressure. The pressure on the pipe in question was only 80 feet.

Mr. EMERY: Do you say that a pipe tested at 300 feet will, when laid, break at 80 feet pressure?

Witness: Yes, sometimes.

Without any cause at all, I suppose?—Without any cause that we can assign.

If the pipe had been strong enough, would it have burst?—Yes, it might have done so. Witness explained that a pipe would sometimes be broken by a steam-roller passing along the road, or through the iron becoming deteriorated owing to the nature of the soil.

Mr. EMERY further submitted that if the Company had a pressure of 80 feet in their pipes outside people's houses, they must see that the pipes were so used that a burst could not result from such pressure. He maintained that if a pipe burst, negligence must be assumed, and need not be proved.

His HONOUR: The Company have the right to put down the pipes; and if no negligence is proved against them, I do not see how they can be held liable for an accident. I find for the defendants.

Mr. CRAIG asked for costs.

His HONOUR intimated that if he allowed costs he would give leave to appeal.

Mr. CRAIG said he would not press for costs, unless the other side applied for leave to appeal.

Mr. EMERY said he would be content for judgment against the plaintiff, without costs, and no leave to appeal.

Mr. CRAIG added that his clients had made an offer, without prejudice, to compensate the plaintiff for his loss.

Coal Contract Dispute.

At the Leeds Assizes, Mr. Justice Grantham and a Jury were engaged on Wednesday and Thursday last week in hearing an action brought by the Barnsley Coal Bye-Products Company to recover damages from

Messrs. Wrigley Bros., coal merchants, for breach of contract. The plaintiffs contracted with the defendants to supply them with 2000 tons of screened gas coal at 14s. per ton. Messrs. Wrigley Bros., in their turn, entered into a contract with the Dukinfield Corporation to sell them 2000 tons of double-screened gas coal at 17s. 6d. per ton; and this contract they filled by delivering the screened coal which the plaintiffs had contracted to supply. The Corporation, however, complained that they were not receiving coal of the quality for which they contracted, and Messrs. Wrigley Bros. passed on the complaints to the plaintiffs. The plaintiffs put the coal over a screen with a larger mesh than formerly; but the Corporation still complained, and eventually both they and Messrs. Wrigley refused to receive the coal, and the plaintiffs were left with 1312 tons of it on their hands. The plaintiffs claimed as damages £171 9s., which was the difference between the price actually obtained and that which the defendants would have had to pay under the contract. The defence was that the coal supplied was not of the quality which the plaintiffs, under their contract, undertook to supply; and in respect of this alleged breach of contract, a counterclaim of £100 was brought. The Jury gave a verdict for the plaintiffs for £168.

Acetylene Explosion at Dawlish.

An action was last week brought, in the Exeter County Court, by Frederick Davey, who claimed damages from Messrs. Willey and Co. under the Employers' Liability Act. An acetylene plant (not, however, of the defendants' own make) was installed at the Royal Hotel, Dawlish; and the plaintiff, who was in Messrs Willey's employ, was sent there to assist in changing the fixtures in the hotel for the new light. While doing this, he was asked to assist in getting the generating plant to work, which he did. Some days afterwards, the light went out; and on plaintiff going to the gasholder, he found it overturned, and the gas escaping. He and a colleague named Backalake opened all the taps, thinking the gas would eventually force the air through the pipes. Backalake unscrewed the main cock, which was a right thing to do, though he should have first disconnected it. The apparatus, however, exploded, and plaintiff, who was ten feet away, was thrown back against the wall. One of his fingers was blown off; and for days he was black about the body. He had made applications to join the staff of the Royal Engineers; but the accident would prevent him obtaining any such appointment. His wages were 35s. a week; and after the accident he was eleven weeks out of work. He was still in Messrs. Willey's employ. The firm were now making acetylene plant of their own of better construction. Since the accident, the gasholder at Dawlish had been brought back to Exeter, and efforts made to improve its construction. If it had been properly constructed, Backalake and himself would not have been called upon to do what they did. In cross-examination, plaintiff said that if the holder had first been emptied and then refilled, so that the air and gas could have been blown out of the pipes, there would not have been danger of an explosion; but he did what he thought best. Evidence having been given in support of the plaintiff's case, Mr. Harris (who appeared for the defendants) contended that, in point of law, an action could not lie. The clause under sub-section 1 of the Act under which the action was brought, applied to what was used by the manufacturer for the purposes of construction, and not to the article when it was produced. If the Legislature had intended that the employer should be liable in case of his turning out a defective article, it was only reasonable to suppose that it would have been provided for in the Act. But the clause most expressly limited the liability to what was used in the ordinary course of trade for the purpose of manufacture. Mr. Baker (for the plaintiff) quoted, as favourable to his case, the words in the preface to the clause of the Act—"by reason of any defect of the machinery connected with the business of the employer." The words "connected with the business" were, he maintained, intended to meet a case of the kind before them. His Honour Judge Woodfall said it would be straining the Act in an unprecedented way if, where it was the business of a manufacturer to make gasholders, it was to be understood that the holder, after it was sent out to the customer, was machinery used in his (the manufacturer's) business. He must nonsuit the plaintiff. At the same time, he thought the matter might have been considered in some other way. That being so, he should give plaintiff leave to bring another action if he was so advised; but he would ask him to seriously consider whether he had any case before he decided to do so.

Birkenhead Water Supply.—The Birkenhead Gas and Water Committee have appointed a Sub-Committee to make full inquiry and to report as to the present and future supply of water to Birkenhead, with authority to call in expert evidence and assistance.

Cost of Public Lighting at York.—Some discussion took place at the last meeting of the York City Council on the charges of the Gas Company for public lighting. A communication was read from the Secretary of the Company stating that, after fully considering the application of the Council for a rebate of 7½ per cent. off the proposed charges, the Directors felt that they could not accede to the suggestion. Mr. Gray moved that the Council were of opinion that the letter was one which they could not accept, and that they refer it to the Streets and Buildings Committee, or any Special Committee, to report on all matters relating to the question at or before the September meeting next year. Alderman Dodsworth seconded, and said he was prepared to show to the Streets and Buildings Committee, if they would confer with the Electric Lighting Committee, that the Committee could light the whole of the city for at least £1000 a year less than they were at present paying the Gas Company. Alderman Wragg thought it would be a great mistake for the Electric Lighting Committee to have the whole of the lighting of the city in their hands. On a division, 35 voted for the motion, and none against. Alderman Coning moved, and Alderman Dale seconded, that the letter be referred back to the Streets and Buildings Committee. This was defeated by 23 votes to 13. It was then agreed that the question of the Special Committee be adjourned until the next meeting.

MISCELLANEOUS NEWS.

ANSWERS TO QUESTIONS ON GAS MANUFACTURE.

In the "JOURNAL" a fortnight ago, we gave what was intended to be a first instalment of some "Answers to Questions on Gas Manufacture," which had been prepared in the hope that they might be useful to students for the next examinations; and readers may naturally be looking for other chapters on the same subject. Attention has, however, been called by Mr. Walter Grafton to the fact that Mr. Hendrickson had made use of his lectures at the Polytechnic, and that he had not given his assent to such publication. We regret, therefore, that we shall be unable to insert further portions of Mr. Hendrickson's communication.

LONDON COUNTY COUNCIL AND GAS TESTING.

Friction with the South Metropolitan Gas Company.

At the Meeting of the London County Council last Tuesday—Mr. A. M. TORRANCE in the chair—the Public Control Committee brought up a report with reference to the gas-testing stations of the South Metropolitan Gas Company at Hill Street, Peckham, and the Blackfriars Road, which have been closed in order to fit up new and improved appliances. These have been in position for some time; but the Company have refused to comply with the notification of the Gas Referees as to cleaning out the service-pipes. The Referees, therefore, will not certify the apparatus. In 1889, the Company twice cut off the supply of gas to the testing-place at Hill Street. After considerable correspondence and interviews between the Board of Trade and the Company, the supply was reconnected; but, owing to a return of low illuminating power being made by the Council's Gas Examiner in 1890, the supply was again cut off. On April 29, 1890, the Council decided to ask the Board of Trade to take the necessary steps for amending the Gas Acts, with the object of making the Gas Companies liable to penalties where they failed to observe the requirements of the Acts as to the provision of official testing-places, testing apparatus, and other things necessary for the official examination of the gas supplied by such Companies. Subsequently, the Board of Trade requested clauses, to give effect to these and other proposals, to be sent to them; but no further action has been taken. The Council have been legally advised that they cannot proceed until they have a formal certificate from the Board of Trade. They have communicated with the Board several times; and the last answer, verbally given by the Solicitor, was that he could not say when the Board could deal with the subject. Therefore the Committee brought up the following recommendation: "That the Board of Trade be urged to deal as soon as possible with the matter of the refusal of the South Metropolitan Gas Company to comply with the notification of the Metropolitan Gas Referees with regard to the cleaning out of the service-pipes at gas-testing places."

Mr. W. C. JOHNSON moved the reception of the report.

Dr. W. J. COLLINS said he desired to make a remark on the question of the testing of gas. As members of the Council were aware, they had for many years past proposed the adoption of the portable photometer for gas testing, in order that they might, if possible, secure to consumers of gas that the testing should not be only that which was supplied to certain testing-stations which were recognized, but that consumers should actually receive the 16-candle gas which they were supposed to receive. So far as he could gather from the report, in the South Metropolitan Company's area there were six recognized testing-stations; but in two of them there had not for many months been any actual tests. The test made at the station was not a very valuable one; but it was to some extent a protection to the consumers, and he understood that they had been deprived of it. This was because of some quarrel between the Gas Referees certifying the apparatus to be used in the testing-station and the Gas Company, who refused to do something to the service-pipes. He understood that the remedy suggested by the Committee was that the Board of Trade should certify the matter to the Attorney-General; and representations had been made to the Board on the 29th of August, the 2nd of September, the 1st of October, and the 7th of November, apparently with no result whatever. He thought the recommendation should not be in the somewhat lax form in which it was drawn; and therefore he would suggest to the Chairman of the Committee that, instead of the words "as soon as possible," they should substitute "at once." It seemed to him that there had been great negligence on the part either of the Board of Trade or somebody else responsible for this matter; and he hoped severe pressure would be put on the Board, in order that this small amount of security might be again secured to the consumers of gas in the Company's area.

Mr. JOHNSON said he was glad Dr. Collins had taken the opportunity of calling attention to this question. The matter was one which the Public Control Committee had had under consideration for nearly six months; and they had made repeated efforts, as set out in the report, to obtain the assistance of the Board of Trade. If Dr. Collins thought the word "immediately," instead of "as soon as possible," would have any effect with the Board, he (Mr. Johnson) was sure the Committee would be glad to make the emendation.

The recommendation, as amended, was agreed to.

The Committee also, in their report, reminded the Council that on the 30th of July last they decided to urge the Government to promote legislation on next session to give effect to the recommendation of the Departmental Committee on Water Gas. They added that a communication had now been received, stating that the President of the Board of Trade would be prepared, if opportunity offered, to introduce a Bill to give some authority power to make the necessary regulations with regard to the supply of water gas.

At the meeting of the Camberwell Borough Council on Wednesday,

the Works and General Purposes Committee reported the consideration of a letter which had been received from the Clerk of the London County Council stating that, in consequence of a complaint as to the illuminating power of the gas supplied by the South Metropolitan Gas Company in the neighbourhood of Herne Hill, a number of tests had been made with the portable photometer. The lowest illuminating power was 13·5 candles, and the highest (in one instance only) 15·4 candles. A further letter had been received from the Council on the subject dealt with in the report presented by the Public Control Committee at the meeting on the previous day, the principal portions of which are given above. The Council suggested that the Borough Council should send a communication to the Board of Trade explaining the urgency of the matter. The Committee recommended that the communication should be forwarded to the Board, with an intimation that the absence of a testing-station was a great inconvenience to the inhabitants of the borough, especially in view of the adoption of 14-candle gas, and a request that the Board would take the earliest opportunity of enforcing compliance with the Act by the Gas Company. The recommendation was adopted.

GLASGOW CORPORATION GAS BILL.

Power to Charge for Escapes—The Manufacture of Fittings.

A Meeting of the Glasgow Corporation was held last Thursday—Lord Provost CHISHOLM presiding—for the purpose of taking into consideration the Gas Bill to be promoted next session.

Mr. DICKSON moved the approval of clause 15, which empowers the Corporation to charge against owners the expense of preventing escapes of gas from service-pipes.

Mr. W. F. ANDERSON objected to the proposal to give power to the Corporation to enter property and interfere with gas-pipes which they did not at present possess.

The CLERK (Mr. Bowers) said the purpose of the clause was to empower the Corporation, whenever they received a complaint of an escape of gas from service-pipes belonging to owners of property between the Corporation mains and the meters, at once to take steps to stop the escape, and to charge such owners with any expense incurred. As a matter of fact, the Corporation had for many years past been in the habit of stopping leaks on private gas-pipes without charging the owners with the cost. This practice had led to the belief that all such pipes were the property of the Corporation, that they were bound to keep them in repair at their own cost, and that they were liable for any accident which might be brought about by the escape of gas from them. The object of the clause was therefore to put this matter on a proper basis, and to make it quite clear that, while the Corporation were to have power to stop escapes of gas on private pipes, they were not the owners of the pipes, and would be entitled to charge the owners with the cost of repairs.

The clause was approved.

Mr. DICKSON next moved the approval of clause 16, which provides that there should be no penalty in case of unavoidable failure to supply gas.

Mr. W. F. ANDERSON said a man might require to shut up his business premises on account of the failure of the gas; and were they to throw on that man the burden of finding out the technical cause which compelled him to shut up his premises? He held this was unfair.

The CLERK said that Mr. Anderson was under a misapprehension. The object of the clause was to put the Corporation, as regarded their gas undertaking, in exactly the same position as they were in with reference to electric lighting. The clause was inserted in almost all the Gas Acts obtained in the last session of Parliament. It was to be observed that if the Court found the failure to supply arose from negligence or fault on the part of the Corporation, the latter would still be liable for the penalty provided by section 36 of the Gas-Works Clauses Act, 1871.

Mr. PATON said this was an exceedingly unfair clause. In his opinion, they should not have it. He submitted that, although the Corporation had a monopoly, that was no reason why they should contract themselves out of what might prove to be a gross injustice. He moved disapproval of the clause.

Bailie FERGUSON seconded.

Mr. R. M. MITCHELL remarked that a great deal had been said about the gas-works being a monopoly. They did not make gas for a profit, but to supply it at the cheapest possible price. The business was a difficult one to conduct, and there were numerous circumstances quite beyond their control which could cause a failure of gas. All they wanted was not to be bound under any penalty for such things.

Mr. ALEXANDER did not consider the clause revolutionary. They were simply going on the lines followed in other departments. If on account of the electricity being cut off he failed to reach his business in time, he had no right to demand compensation from the Tramway Committee. The same remark applied to the water. What was good enough for the Tramway Committee and the Water Committee, should be good enough for the Gas Committee.

On a division, five members voted for the amendment; and the clause was approved by a large majority.

Mr. DICKSON having moved the approval of clause 21, which empowers the Corporation to provide, sell, let for hire, and fix up, alter, remove, but not to manufacture, lamps, meters, motors, electric lines, fittings, apparatus, &c.

Bailie STEWART proposed that power should be taken, not only to hire or supply, but also to manufacture.

The amendment was not seconded.

In the course of discussion, several members urged that the words "shall not manufacture" should be deleted. This was agreed to; and the clause was then approved.

Owing to the bursting on Tuesday night of the principal aqueduct in the Place Garibaldi, Nice was deprived of a supply of water for two days last week.

COLWYN BAY GAS ARBITRATION.

Monday, Dec. 2.

(*Before Sir* GEORGE BRUCE, *Umpire.*)

Proceedings in this arbitration (which was held, under the Lands Clauses Act, to determine the price to be paid by the Urban District Council for the undertaking of the Colwyn Bay Gas Company) were opened to-day at the Westminster Palace Hotel. Mr. THOMAS NEWBIGGING, M.Inst.C.E., was the Arbitrator for the Company; and Mr. CORBET WOODALL, M.Inst.C.E., for the Council.

Mr. HONORATUS LLOYD appeared for the Company; Mr. BALFOUR BROWNE, K.C., and Mr. F. E. SMITH represented the Council.

Mr. HONORATUS LLOYD said the Company was registered under the Companies Acts in 1883; and in the following year they obtained a Provisional Order enabling them to supply gas in the district. The share capital was then limited to £8000, and the loan to £2000. The rise of the population and the success of the place were so great that, in 1896, the Company applied to Parliament. They were incorporated as a statutory Company, and the capital was fixed at £8000 original capital and an additional £20,000 (with certain limitations as to the time at which it might be raised), and £7000 loan. Section 27 limited the profits of the Company, and provided that the amount to be divided among the shareholders in any year should not exceed 10 per cent. on the original capital, and 7 per cent. on the additional capital. By section 67, the standard price was fixed at 5s. per 1000 cubic feet; and then came the provision for the sliding-scale, by which for every penny increase in the charge there was to be 5s. decrease of dividend on the 10 per cent. capital, and 3s. 6d. on the 7 per cent. For a similar decrease in the price, the dividend was to rise in the same ratio. By section 77, the Urban District Council were given power to purchase; and the Company were not to oppose, except upon details. The Council gave no notice of their intention to purchase until Dec. 28, 1900; but such powers bound the hands of the Company to a very considerable extent. They had an enormously increasing district and demand; and at the same time they were naturally anxious not to do anything unjust in the event of the purchase taking place. In 1899 there was a movement in favour of purchase; but the ratepayers decided against it. The Council, however, gave notice of purchase on Dec. 28, 1900; and in 1901 they obtained their Act. In 1899, when the Council first proposed to purchase, they called upon the Local Government Board to hold an inquiry, with a view to their giving consent; and they then took about the same view of the Company's prospects as was held now by the Company themselves. The district of Colwyn Bay was formed into a Local Board in 1887. The rateable value of that date was £20,000, while now it was £54,000—a very remarkable increase in fourteen years. The growth of the population was equally remarkable. In 1881, it was 2418; in 1891, 4754; and in 1901, 8683—in other words, it had nearly doubled each ten years. This was absolutely unique; and there was no doubt Colwyn Bay had gone ahead in a way which was unknown in North Wales. It was a substantial and popular residential place, and was becoming more popular every day, because it was within a convenient distance of Liverpool and Manchester. Express trains were run, and gentlemen from these towns were building houses at Colwyn Bay. In addition, it had a large influx of visitors during the summer months, varying from 20,000 to 25,000. It would not be disputed that the Company had a very great future. The works were situate upon a low piece of ground in a little valley between the highroad and the railway, and immediately adjoining the railway line. They were in excess of present requirements. In 1893, the gas sold for private consumption was 7·6 million cubic feet; in 1894, 8·4 million feet; in 1895, 10 million feet; in 1896, 12 million feet; in 1897, 16½ million feet; in 1898, nearly 20 million feet; in 1899, over 24½ million feet; and in 1900, over 28½ million feet. With regard to the stability of this increase, Messrs. Lass, Wood, and Drew's tables showed the number of meters on hire in December, 1900; and it would be seen that the Company were dealing with a large number of small consumers—the most valuable for a gas undertaking. In 1899, the number of 2-light meters was 4, while there were 20 3-light meters, 13 5-light, 146 10-light, 37 20-light, and 21 30-light. In 1897, the total number of meters was 490; and in 1900 it had risen to 944. If the Company had been free to do as they pleased, and raise more capital, they could have supplied very much more gas than they had done. Then the list of the Company's mains was given. First, there was a 12-inch main, 2558 yards long, which had been laid in 1897. They were obliged to do this, in order to supply gas at all. The consumers were calling out for more gas; and they could not get it through the 6-inch main which was in position there before. There were 3238 yards of 2-inch main, 759 yards of 1½-inch, 1914 yards of 1¼-inch, and 62 yards of 1 inch. The three last were pipes which had been originally laid as long service-pipes for isolated or straggling customers; but they were tapped here and there, and had come into use more or less as mains. When the churches and chapels were taking their maximum supply, there had not been enough gas to go round. In view of the enormous increase, the Company had not been able to lay mains enough in the streets. There were streets upon streets where people were calling for gas, and the Company had not laid an inch of main. With regard to the present financial state of the Company, the capital actually raised at Dec. 31, 1900, was: Original capital £8000, additional capital £8400, and premiums £3311—making together £19,711. With £3500 of loans, this made £23,211. At that time they had £7062 12s. 10d. capital overspent. Since this date, they had borrowed a further sum of £1400, which reduced the overspent capital to £5662 12s. 10d. But they had spent further capital since the passing of the Act, amounting to £1982 14s. 5d.; so that the capital now overspent was £7645.

Mr. BALFOUR BROWNE remarked that the figure of £1982 had not been agreed to by the Accountants.

Mr. LLOYD said he did not suppose it had; it was since the Accountants' date. Nearly the whole of the amount of overspent capital up to December, 1900, had gone upon the new holder, which was absolutely necessary; while the £1982 was largely due to meters and stoves.

With reference to revenue, he submitted it might be applied, for the purpose of assessing the value of the undertaking, as follows: In order to find out the value, one had to look first of all at the past history of the Company, and secondly at its future prospects. One could not dive into the immediate present without regard to the past or future. This had been done in all instances where the value of gas-works had to be assessed, by finding out what maintainable profit the Company had earned and applying so many years' purchase to it. If the last year's trading of the present Company were stereotyped as likely to be the earning power for the future, and multiplied by *x* number of years' purchase, a monstrous injustice might be done to either one side or the other. In consequence of certain disturbances and temporary causes, it was a bad year, and it would be unjust to the Company to stereotype it; but if it had been an enormously successful year, injustice would be done to the Council. It had, however, been the habit to take the last year, or an average of three years, as giving a fair indication of the value of an undertaking. He was going to do that in the present case. They had taken 1900, but had made certain comments upon it in order to bring it up to the standard to which he had already been alluding. There were certain temporary causes which he wished to be taken into consideration, with a view of getting a model year which would fairly represent the Company's position. First, with regard to coal. In 1898, it had cost £1737, in 1899 £2230, while in 1900 it had risen to £3492 8s. 9d. The representatives of the Urban District Council might very fairly observe that, upon the enormous rise in the output, it was to be expected that there should be a corresponding increase in coal. That was true; and if the increase were merely proportionate, he would have held his tongue.

Mr. BALFOUR BROWNE: I should make one other remark. You must look at your coke.

Mr. LLOYD said he quite agreed; and they must also look at the residuals. But taking all these things into consideration, still the net price of coal showed a very large increase. In 1898 the cost was 14s. 3·7d. per ton, in 1899 15s. 8·5d., and in 1900 19s. 7·4d. Coke in 1898 brought in £397, in 1899 £597, and in 1900 £1057; while tar rose from £116 to £196, and liquor from £13 17s. to £71 8s. In coke, tar, and liquor the percentage rose from 6 14 to 10·84. The net price of coal was, in 1898 £1209 16s. 4d., in 1899 £1500 14s. 7d., and in 1900 £2167 7s. After making all allowances, there was a very large increase in the price of coal. Therefore some rectification must be made in regard to that item for 1900, in order to get at a model year. The calculation as to what this rectification should be might be a difficult one. Carbonizing wages were greater in 1900 than in previous years, which was due to the fact that the Company were short of storage, and therefore had to work more retorts than they otherwise would have done. Gasholder accommodation was now provided; and in future the wages would go back to their old point. In addition to this, they had put in labour-saving apparatus. But the corrections were not all in favour of the Company. In the next three items—repair and maintenance of works, wages of inspectors, and repairs of mains and services—they went in favour of the Council. On the item, depreciation of cookers, a correction must be made in the Company's favour, and also with regard to the cost of opposing the London and North-Western Railway Company's Bill. That Company had a Bill in Parliament last year for widening their line; and a part of the road to the works was included in the limits of deviation. The Gas Company succeeded in protecting their rights; but such an experience was one of a lifetime. The price charged for gas was 4s. 2d. per 1000 cubic feet for lighting, and 3s. 4d. for heating and cooking. Under the sliding-scale, a dividend was allowed of 12½ per cent. on the 10 per cent. capital, and 8¾ per cent. on the 7 per cent. The Company, however, instead of paying this, had only divided 10 per cent. and 7 per cent., and put the other to reserve. After payment of interest on mortgages and temporary loans, £1735 was required to pay the authorized dividend under the sliding-scale. In 1900, when only part of the capital was raised, the amount required for the full dividend, after payment of interest on mortgages and temporary loans, was £1656. As a matter of fact, upon the accounts as they stood, they had £1593; but if this were stereotyped as the maximum the Company could earn in future, a great injustice would be done, because in a model year more than the sum of £1656 would be available. In future, the amount would be £1735, after paying interest; and with a model year, without any disturbing elements, this would be easily available. The Company asked for 28·57 years' purchase upon £1735 (which amounted to £49,568 19s.), 10 per cent. for compulsory sale, and the £7645 of capital overspent. So confident were the Company in the prospects of the undertaking, that they were prepared now to pay the Council's expenses up to date if they would forego their right to purchase. They would also pay the costs of the necessary Act. He asked that the Council should refund the amount of overspent capital, because every penny had been expended upon the works, and they were substantially in excess of the present requirements. The value of the excess works exceeded the amount of overspent capital.

Mr. *Samuel Wood*, of the firm of Lass, Wood, and Drew, was then called, and questioned as to certain items in the accounts. Although in 1900 the profit available for dividend was only £1593 as against the required sum of £1656, yet in 1899, when £1380 only was required, £1950 was available—being an excess of £600.

Major *Birch*, a Director of the Company, and for many years a resident at Colwyn Bay, substantiated Counsel's opening statement as to the way in which the place was growing, and as to the excellent prospects of the undertaking.

Mr. *J. M. Porter*, a surveyor and land agent, also of Colwyn Bay, stated that, from actual sales within his own knowledge, the price of land had quadrupled within the last few years.

Mr. SMITH said they did not dispute that Colwyn Bay was a growing place. This was a well-known fact.

Mr. *E. H. Stevenson*, M.Inst.C.E., in answer to Mr. LLOYD, said he had made himself thoroughly acquainted with Colwyn Bay and the gas-works. The situation of the latter was exceedingly good in every respect, especially now that the Railway Company had power to double their line. In all probability, they would give a siding into the works, which would result in very considerable saving. At present it cost 1s. 6d. per ton to cart the coal, and 1s. 3d. per ton to cart the residuals back. The growth of the undertaking was such that in a very short time a large benefit would accrue to the gas purveyors through the siding, even if they had to pay the cost of a box and a man. The works were situate between Colwyn Bay Station and Mochdre, which latter place had no goods accommodation at all. The area of the land was 4½ acres.

Mr. LLOYD: What do you say as to the design of the buildings and apparatus?

Witness: I think the design is good, and also the condition; and the greater part of the buildings and plant is modern.

Have you made a structural valuation of them?—Yes. I find that the whole of the capital supposed to be expended is represented, including the amount which has been spent this year, although some of that has not been taken into my structural valuation.

The UMPIRE: Will you tell us what your structural valuation is?

Witness: It is £31,902, including the cost of the Act and the Order, which amounts to £1702. Then there has been expended upon mains and meters £1195. I leave out the works there which have been paid for this year, because they are included in my structural valuation.

Mr. LLOYD; Speaking generally, are the works sufficient for the present requirements?

Witness: They are all in excess.

You can give us the size and capacity of each of the different portions of the works, say by how much they are in excess?—Yes. I had better first say how I have calculated this. In a case like the present Company, I always take the average daily make of a maximum week, because where there is a large excess of holder-room, what is not needed one day is stored up for use on another. In this instance, the average of the week is 135,000 cubic feet. I find that the retorts are equal to a make of 180,000 cubic feet per day. The whole of those retorts can be taken into effective use at any time. As recently as a month ago, when certain of the retorts in the new house were being repaired, the others were used. The condenser is a wrought iron annular condenser, and consists of four towers. I consider the condenser and cooling main are equal to a daily make of 301,000 cubic feet of gas. That gives 130 per cent. excess.

Then the exhausters?—They are two in number. One has a nomina capacity of 120,000 cubic feet per day, and the other of 360,000 feet. They are very ample. There is an excess in the large exhauster. There is only one boiler; but it is a new one. In a small works of this description, I do not think it is necessary to have a second boiler. There are six purifiers. They are about 125 per cent. in excess. The station meter is calculated to pass 360,000 cubic feet a day, which gives an excess of 175 per cent. There are three gasholders, with a capacity of 14,000, 26,500, and 195,500 cubic feet—making a total of 266,000 cubic feet, or an excess of about 100 per cent. The large new one was only completed towards the latter part of October, 1900.

The buildings include a house for the foreman, offices, stores, and stables?—Yes.

Witness (continuing) said there was quite 2 acres of land not occupied. He thought, considering the history of the Company, that the works had been laid out exceedingly well. It was economical of the Directors to erect works in excess of the present requirements. It would have been a foolish policy, with the enormous increase, not to have done so. Of this, of course, the Council would reap the benefit. The 12-inch main was laid within the last few years. It was absolutely necessary; and the Company did not overstep their capital powers at the time. They only overstepped them within the last twelve months, and probably because they were driven to it, only having 50 per cent. of holder room. They thought, very rightly, that it was a hundred-to-one chance that they would be bought up at all. He had taken Messrs. Lass's figures, and accepted them as a guide for the present and the future. A normal year must be taken, and corrected for any irregularities which had occurred in the year. For this purpose, he had taken the figures supplied for 1900, and made the necessary corrections

Tuesday, Dec. 3.

Mr. *Stevenson*, in further examination, said that, in view of the growth of the undertaking—and, indeed, independently of that—the revenue of £1735 requisite to pay the full dividend would be more than maintainable. To day the Company could reduce the price of gas, and next year pay a bigger dividend. This being the case, he had taken the maintainable amount divisible among the shareholders at £1735. The following was his valuation of the undertaking:—

Statutory dividends on		
£8000 at 12½ per cent. =	£1,000	
£8400 at 8¾ ,, =	735	
	£1,735	
£1735 × 28·57 years' purchase		£49,568 19 0
Add 10 per cent. for compulsory sale		4,956 18 0
Compensation for dividends		54,525 17 0
Add overspent capital	£7,366 17 6	
Less borrowed on loan since Dec. 30, 1900	1,400 0 0	
	£5,966 17 6	
Add capital expended from Jan. 1 to July 26, 1901	1,982 14 5	
		7,949 11 11
Total compensation claimed		£62,475 8 11

He claimed the amount of overspent capital for this reason: In 1896, when the Company went to Parliament, the quantity of gas sold to private consumers was 10 million cubic feet. There was not much sold for public lighting. The increases had been at a comparatively small rate. There was no idea of the enormous growth which had taken place since; and therefore the limitation then put in was apparently right and just. As the Company were hung up practically for five years—the Council being able to purchase—they could not go to Parliament again; while at the same time they could not be released from the obligation of providing the gas which the public demanded.

The amount of overspent capital was less than the value of the excess works.

Mr. BALFOUR BROWNE (in cross examination): Was Mr. Lloyd right in saying yesterday that the wages for carbonizing were so high because in that particular year you had not sufficient gasholder capacity?

Witness: Partly because of that, and partly because of the labour-saving apparatus which we put in at the beginning of the year.

Might it not also be due to the falling off in the make per ton?—No.

Why not?—Because you could not have more than four settings going; and they were going that year.

Do not more tons used for the same amount of gas mean more wages?—They mean more labour, but not necessarily more labour paid for.

That is the first correction you wish to make. Now the second is that you want to add to the revenue £88 1s. for 5 per cent. depreciation on stoves?—Yes; 5 per cent. I say is sufficient.

Is the usual amount granted that Messrs. Lass, Wood, and Drew allow—10 per cent.?—No. It is usual for companies and for local authorities, for purposes for which I am not allowed to say, to put 10 per cent. on the depreciated value, not 10 per cent. on prime cost.

We differ, of course; but I am not going to argue the matter?—It is always so.

Mr. CORBET WOODALL: It is not always so.

Witness: Well, nearly always.

Mr. BALFOUR BROWNE: Now I take the deductions of the income. In your 3·77d. per 1000 cubic feet sold for repair and maintenance of works and mains, have you included a figure which appears in Messrs. Lass's account—viz., 0·54d. debited to inspectors?

Witness: Yes,

Have inspectors got anything to do with maintenance of works or maintenance of mains?—Yes; they have to do with the maintenance of mains to some extent.

To an infinitesimal extent?—No.

Is it a fact that these inspectors have to deal principally with the meters?—I do not know it is a fact.

Do you know they not only have to deal with meters, but have to collect the money from the slot-meters?—I know they do that; but my reason for putting it in is that at this small works there is barely anything put in for inspectors, and we have to compare like with like. They are included in the maintenance of mains or of the works generally; but they are not put separately into the accounts,

Now I want to turn to your multiplier. I suggest to you that at the present time a multiplier of 28·57 is ridiculously high?—I agree with you, if it is only the existing dividends you are buying; but you are not only buying those.

Suppose it were only existing dividends, what do you say would be the proper multiplier?—That, again, depends upon the undertaking. In this case, I should probably put it at 26¾ years' purchase.

I have here some recent sales of gas shares, taken from the "JOURNAL OF GAS LIGHTING." They quote Brentford, Brighton and Hove, Bristol, British, Bromley, Commercial, Crystal Palace, Gaslight and Coke, Liverpool United, Sheffield, South Metropolitan, Southampton ordinary, Tottenham, and West Ham—some of the best Gas Companies in the country?—Yes; and some are about as bad as they could be.

Which do you pick as the best?—Of course, the South Metropolitan, for a standard price and sliding-scale would be the best.

The very highest?—I think so.

I see the South Metropolitan shares are sold at 25 years' purchase?—Yes.

Do you know the average of the whole of the Companies I have given you is £4 7s. 2d. per cent.?—I daresay it is.

And that is a lower figure, of course, than 28 years' purchase?—Yes. The Colwyn Bay Company is thoroughly secured, and has not only the prospect, but the absolute certainty, of an increase in dividend next year.

Mr. NEWBIGGING: Were these sales which have been quoted compulsory sales?

Witness: No; it is a bargain between two parties.

That is quite a different thing, is it not?—I think it is, myself.

Mr. LLOYD (in re-examination): With regard to depreciation, it has been suggested to you by Mr. Balfour Browne that 10 per cent. upon prime cost is usually allowed. It is your experience that it is not so?

Witness: My experience is that companies do it; but it is not a proper charge to make. There is nothing to justify it in any Act.

I observe that Mr. Wood, in his report upon it, speaks of having adopted a high figure in this case?—Yes. There was a time when companies depreciated their meters until they depreciated them off the books entirely, although they were there. That was, again, a way of keeping their capital down.

With regard to the carbonizing wages, as I understand you, they were too high for the year in question?—Yes.

A suggestion was made yesterday that, inasmuch as you claimed a reduction of carbonizing wages because the gasholder accommodation was short, and you were also seeking to get overspent capital, part of which had been expended on the holder, you were trying to get the same thing twice. In the first place, the wages were too high because the gasholder accommodation was deficient?—Yes.

When the new holder was constructed, the accommodation was not only sufficient, but in excess?—Largely in excess.

If it had been made only sufficient, the wages would have been normal?—Yes.

Mr. *W. A. Valon, J.P.*, was called, and presented his structural valuation, the totals of which were as follows:—

Land	£1,407	0	0
Works and plant	17,761	0	0
Mains	6,355	0	0
Meters, main taps, &c.	2,127	0	0
Cookers	1,542	0	0
Services	935	0	0
Lamps	513	0	0
	£30,640	0	0
Cost of Act and Order	1,701	12	7
Total	£32,341	12	7

The valuation of the undertaking as a whole was:—

Profit on gas for year				£1,878	16 2
Repair and maintenance of works and mains, *plus* half the amount debited to inspectors				183	7 9
Cost of opposition to Railway Bill				101	19 2
Net cost of coal				443	15 11
				£2,241	3 6
Deduct interest on mortgages	£122	10	0		
,, ,, temporary loans	152	15	10		
				275	5 10
Adjusted profit available for dividend				£1,965	17 8

The remaining figures were similar to those of Mr. Stevenson, with the exception of the amount for overspent capital, £7062 12s. 10d., as against Mr. Stevenson's £7366 17s. 6d. The total compensation claimed by witness was therefore £62,171 4s. 2d., as against Mr. Stevenson's £62,475 8s. 11d.

In cross-examination by Mr. BALFOUR BROWNE, witness admitted that the decreased output per ton of coal in 1900, owing to its inferior quality, should be taken into account; and this would make a correction in the figures to the extent of £157—leaving the adjusted profit available for dividend at £1808 17s. 8d.

Mr. *Robert Porter* said he agreed with the structural valuation of the Colwyn Bay works which had been put in. The works were largely in excess of present requirements. He made the amount of overspent capital £7797 9s. 7d., and the maintainable profit £2152 in a normal year. The total compensation claimed by witness was £62,323 6s. 7d., *plus* the capital expenditure since the passing of the Council's Act to the date of transfer.

This closed the case for the Company.

Mr. BALFOUR BROWNE, in opening the case for the Council, said he agreed that, in order to obtain a model year, an actual year's accounts must be amended to some extent. He denied, however, that the suggestions of the Company's advisers were proper amendments to be made. As a matter of fact, the only correction necessary in the accounts for 1900 was in favour of the Council. The whole object of the Company's witnesses was by some means to get the amount available for division above the £1735 which was required to pay the statutory dividend, at the present price of gas. This they had tried to do in different ways; but when their accounts were looked into, he submitted it would be found that they had failed Mr. Stevenson was careless about the coal, because, by other adjustments, he thought he had got the figure he wanted. On the other hand, Mr. Valon was careless about the carbonizing, because he added £443 for the excessive price of coal, which he afterwards admitted was wrong to the extent of £157, which he took off. Then he added £88 1s. for depreciation of cookers—he did not know for what reason. With regard to the cost of the opposition to the London and North-Western Railway Bill, such an expenditure was by no means uncommon, and might clearly occur again. Companies had to run the gauntlet of rating authorities, and so on. The scheme of valuation which the Council presented would be given by Mr. Chester, who made the amount available for dividend £1474, and capitalized this at 25 years' purchase, and then added £5662 for the value of excess works—making the total value £42,512. With regard to the correction for coal, this was a thing which might occur again; and it was nothing very excessive, having regard to all the facts. No doubt the electric light which was already installed would play a very important part in the future in Colwyn Bay, with its hotels and lodging houses. As to the multiplier, he had let Mr. Stevenson choose the best Company; and he selected the South Metropolitan, whose stock was selling at 25 years' purchase. If this were good enough for the South Metropolitan Company, why not for the Colwyn Bay? As to overspent capital, if that were represented in works which had not yet paid anything, he would not say they should not pay for it. But if it had been spent to earn the £1878, the Council would pay for it in the 25 years' purchase. As to compulsory sale, this was not a compulsory sale at all; it was simply a sale by agreement, as the clause in the Act showed. The Company would get the full value of their shares in the number of years' purchase; and yet they asked for nearly £5000 more out of the pockets of the ratepayers of Colwyn Bay. Why? What did they give in return? Absolutely nothing. The principle of giving 10 per cent for compulsory sale was where a person could not be otherwise properly compensated for what was taken from him—as, for instance, when part of a park was taken at the price of agricultural land. No one could say the owner of the park was properly compensated by merely paying that price for it.

Mr. *W. R. Chester*, M.Inst.C.E., in answer to Mr. SMITH, said that he had inspected the Colwyn Bay works and the district of supply. His valuation was as follows:—

Balance of profit for the year	£1,878	
Deduct interest on mortgage	178	
	£1,700	
Deduct interest on deposits	10	
	£1,690	
Deduct for underspent on wear and tear of works and mains	216	
Amount available for dividend	£1,474	
Capitalized at 25 years' purchase	£36,850	
Add overspent capital, representing value of excess works	5,662	
Total value of undertaking	£42,512	

Witness was cross-examined at some length by Mr. Lloyd. First, as to the price of coal, he admitted it was abnormal in 1900, but denied that its effect upon the Company had been great.

Mr. LLOYD: Have you ever claimed as low as 25 years' purchase in a statutory company, when acting for the company?

Witness: I have never acted for a company when the Money Market has been in the same condition as it is now.

In Morley, in 1898, you put it at 30·77 years?—Yes; there were exceptional circumstances.

In Skipton, in 1899, you claimed 30·77 years?—Yes.

And in the Glastonbury case during the present year, when the Money Market operated in the same way as it does now, you valued the works at 28·57 years' purchase, although you were acting for the Local Authority. How do you account for the difference?—I do not remember the circumstances.

Was Glastonbury increasing like this?—No.

How many years difference would you make between a statutory and a non-statutory company?—It depends upon the conditions. It may be two, three, or four years. I have known non-statutory companies to fetch more money than statutory ones.

Mr. *Joseph Hepworth*, M.Inst.C.E., said he made the net maintainable revenue £1606. This, at 25 years' purchase, gave £40,150 to which he added £5662 for surplus works; making the total value of the undertaking £45,812. The introduction of electricity would not decrease the consumption of gas, but it would retard the progress of the increase. It had done so in London, and also at Colwyn Bay. The year 1900 was an abnormal one in regard to the price of coal; and he was sorry to find the cost was not going down very materially.

Mr. SMITH was about to put to the witness the records of actual sales by auction of gas shares from the "JOURNAL OF GAS LIGHTING," but

Mr. LLOYD objected to this.

Mr. SMITH: Are those quotations accurate?

Witness: I have an offer myself of stock now at £4 15s per cent. in a very well-established company—shares which were much better than the Colwyn Bay ones.

In cross-examination by Mr. LLOYD, witness admitted that, should the price of coal go down, the Council would make a tremendous haul if no allowance were made to the Company for the increased cost in 1900.

Mr. *Thomas Parry*, Chairman of the Council, was asked a question as to the clause in the Company's Act giving the Council power to purchase being inserted by agreement. He said it was a matter of agreement, and denied that it was given in order to prevent the Council opposing in Parliament. They would probably have done so if the clause had not been inserted.

Counsel having briefly summed up the case, the proceedings terminated; and the award of the Arbitrators will be given in due course.

BIRMINGHAM CORPORATION BILLS.

A Meeting of the Birmingham City Council was held on Tuesday and Wednesday last—the Lord Mayor (Alderman J. H. Lloyd) presiding—for the purpose of considering the Bills to be promoted by the Corporation in the forthcoming session of Parliament.

The first of these (a General Powers Bill) includes the proposal to acquire a piece of land for the purpose of manufacturing gas and residual products thereon. Each section of the Bill was moved and adopted separately. On Part XIV., which dealt with this matter, being reached, Alderman Beale (who introduced the report of the General Purposes Committee) explained that it was essential that these powers should be obtained at once; and the only opposition to their immediate approval came from Mr. Walthall, who wanted to hear something of the estimates for the application of the £500,000 which the Gas Committee proposed to expend. His desire was ruled out of order; but he was told he could raise the question later. This section and the next four clauses, dealing with the electric light supply, were gone through in less than as many minutes.

The second is a Water Bill, the main object of which is to extend the time granted the Corporation for completing their Welsh scheme. The provisions of this Bill were explained by Alderman Lawley Parker, who said that the time for the completion of the work would expire in June next; and as it could not possibly be finished by that time, the Bill asked for five years for completing the work in hand, and intended to be completed forthwith, and fifteen years for completing works not intended to be done forthwith. Some of the work would not be completed in fifteen years; but Parliament could not grant a longer period, and there would be no difficulty in getting further extensions. Other clauses of the Bill were inserted for sanitary and economical reasons, and referred to the construction of roads and the obtaining of powers for the prevention of sheep washing, &c., on the watershed, with a view to guarding against contamination. Clause 19 of the Bill sought power to apply money during the period of ten years to the redemption of interest on money needed for the works. Alderman Clayton said he thought this clause was likely to damage the credit of the Corporation. It meant that they might borrow money and not pay it off for a hundred years. Alderman Parker said he did not think their credit would be affected in the least. The resolution to promote the Bill was then passed unanimously.

Illuminating Power of Gas at Birkdale.—At the monthly meeting of the Birkdale Urban District Council last Tuesday, a letter, with enclosure, from the Local Government Board, in regard to the application of the Southport Corporation to reduce the illuminating power of the gas, was considered; and it was resolved that the Clerk be instructed to take the necessary steps to oppose the application.

Trade Unions and the Law as to Picketing.—Last Tuesday afternoon, a conference was held at the offices of the Trade Union Congress, London, to discuss the present position of Trade Unions and the law, both from the legislative and the legal standpoint. There were present, Mr. Asquith, K.C., M.P., Sir Robert Reid, K.C., M.P., Mr. Haldane, K.C., M.P., Sir Charles Dilke, M.P., Mr. Edmund Browne, Counsel to the Parliamentary Committee, and the members of the Parliamentary Committee of the Congress. A long discussion took place on the various phases of the judgment in *Quinn v. Leatham* and other picketing cases. A very important course of procedure was laid down for the Parliamentary Committee to adopt, with the result that they decided the following day to promote a Bill next session to amend the law relating to picketing in trade disputes.

NEW GADD AND MASON GASHOLDER AT RETFORD.

The increased demand for gas at Retford has compelled the Gas Committee of the Corporation to provide additional storage; and another gasholder has recently been added to the works. It is a telescopic one, in two lifts, on the Gadd and Mason principle. The outer one is 85 feet diameter and 20 feet deep; and the inner one 83 feet in diameter and also 20 feet deep. The crown of the holder has a rise of 4 ft. 6 in., and is supported on a framing of trussed steel rafters. The tank is 87 feet in diameter and 21 feet deep; the excavation for it being mostly in the red sand rock. The side wall is built in brickwork and cement; the space between the wall and the rock being filled in with clay puddle to render the tank water-tight. The bottom of the tank is dome-shaped, and is also covered with clay puddle with a layer of concrete on top, faced with cement. On the centre of the dome is a brickwork pillar to support the centre post of the holder when at rest. Before being brought into use, the tank and gasholder were put to severe tests by the Gas and Water Engineer to the Corporation (Mr. J. B. Fenwick), from whose designs they, as well as the other two holders, were erected. The holder was twice inflated to its fullest capacity and then emptied in a very short time, when it worked both smoothly and well, and gave a steady pressure. The Contractors for the tank were Messrs. T. Hopkinson and Son, of Retford, and for the holder, Messrs. R. & J. Dempster, Limited, of Manchester. The Committee, Contractors, and the Engineer are to be congratulated on the satisfactory completion of the work in a comparatively short time, as it was only started about the end of April. Moreover, the whole of it has been carried out without hitch or accident of any kind.

LEEDS GAS SUPPLY.

Wages of the Men—The Depreciation Fund.

A Meeting of the Leeds City Council was held on Wednesday last—the LORD MAYOR (Mr. A. E. Butler) presiding—when questions of gas workers' wages and gas-works finances were under consideration.

Alderman LOWDEN, in moving the adoption of the Gas Committee's minutes, referred to the Committee's resolution (*ante*, p. 1479) to the effect that in future the men be not allowed to work more than six shifts per week, that the wages of stokers, firemen, coal-wheelers, drawers, machine attendants, and cinder-throwers be increased by 4d. per shift, and that time-and-a-half be paid for Sunday work. Alderman Lowden said he had a letter from the official of the Gas Workers' Union stating that the men had decided to accept the concession of 4d. per shift "without conditions." The condition the Committee had endeavoured to impose was one which they had thought would be very satisfactory to the workpeople. By preventing the men from working more than six shifts per week, they would find employment for at least a hundred more men. If the terms offered by the Committee were accepted, he believed no gas-workers in the country would be so well paid. If no conditions were made, the stokers, receiving 5s. 6d. a shift, would be able to earn 41s. 3d. a week of seven days; and even with a six days' shift (if it included a Sunday, with time-and-a-half), they would earn 35s. 9d.

Mr. JESSOP seconded the motion.

Mr. SIMPSON moved, as an amendment, that consideration of the minute should be deferred to the next meeting; and this was seconded by Mr. SMITHSON.

Mr. CONNELLAN stated that the men were not anxious to work seven shifts a week. They wanted to have their Sunday off, and did not wish to take their day off in the middle of the week. This, however, was a detail which the Chairman would be able to arrange with the men.

Alderman LOWDEN, in reply, said they could not do without Sunday labour altogether; but they wanted to distribute it as much as possible among the men. He did not care whether the resolution were referred back or not.

The amendment was lost; and the minutes were adopted.

Alderman LOWDEN next proposed—"That the Gas Committee be, and they are hereby, authorized to apply the gas-works depreciation fund, or such portion thereof as may be found necessary, in meeting expenses for repairing or improving the works connected with the gas undertaking during the year ending March 25, 1902." He remarked that the Committee would be quite within their rights in using this money. The price of gas at the present time was 2s. 3d. per 1000 cubic feet, which was lower than in almost any town of equal magnitude. In reducing the price 2d. per 1000 cubic feet two or three years ago, the Corporation made a mistake. At that time people had not the foresight to know that there would be a considerable increase in the price of coal. Later, the price of gas was raised; but the only benefit obtained was 1d. per 1000 cubic feet to meet the increased cost of coal. One disadvantage the department had to suffer was that about 80,000 tons of coal bought at the advanced price would be used in the present financial year. Another was that there had been a big drop in the returns from residuals. It was estimated that the revenue from residuals would be £24,000 less than last year, when a sum of £107,000 was received. This, however, was a matter over which the Council had no control; they had to take the market prices.

Mr. T. WALKER thought the Committee ought to raise the price.

Mr. KINDER said the proposal was not sound finance. During the past six years, £63,000 had gone from the gas profits to relieve the rates. This money would have been very useful just now.

Mr. WILSON reminded the Council that, after 25 years of working, with a capital almost as immense as it was to-day, Mr. Kinder's political friends in the Council had thought fit to accumulate the enormous reserve of £83,000. The particular fund on which it was proposed to draw was over and above the sinking fund; and the sinking fund was sufficient for its purpose.

Mr. BARRAN wanted to know what were the prospects of making both ends meet under existing circumstances.

Mr. BATLEY said he was in favour of using the fund.

Alderman LOWDEN, in reply to Mr. Barran, intimated his belief that

the Committee could go through the present financial year without an advance in price. He thought bottom had been touched so far as the price of residuals was concerned. Last October the contract price obtained was 15s.; this year it had fallen to 7s. Again, he anticipated an advantage from coal buying to a greater extent than in the past year. Last year, despite the advance in price, the average cost of coal to the department was 11s. 10d. per ton only. This year, though there was a considerable reduction on new contracts, the cost averaged no less than 12s. 11d. per ton. The coal which had latterly been bought averaged 11s. In coal alone, therefore, next year, they might hope to have the advantage of 2s. per ton, which was equivalent to £30,000 odd.

The resolution was agreed to.

PROVINCIAL RATES AND GAS, ELECTRICITY, AND WATER CHARGES.

We have received from Mr. James Carter, the Borough Treasurer of Preston, a copy of his usual tabulated statistics of the rates levied and collected, and the charges made for gas, electricity, and water in a number of provincial towns for the year 1901-2. There are 75 towns in all—an increase of three on last year's list; the new-comers being Brighton, Bournemouth, and King's Lynn. The populations range from 684,947 (Liverpool) down to 20,128 (King's Lynn); the rateable value being highest in the city on the Mersey (£4,042,525), and lowest at Stafford (£76,874). The places which are most heavily rated are West Ham, 9s. 8d.; Southampton and Wakefield, 9s.; Rotherham, 8s. 9d.; East Ham, 8s. 8d.; Norwich, 8s. 6d.; Sheffield, 8s. 4⅝d.; and Middlesbrough, 8s. 1d. Those which have the lightest rates are St. Helens, 4s. 10d.; Barrow-in-Furness, 4s. 8d.; Blackpool, 4s. 4d.; Bournemouth and Southport, 4s. 2d.; and Lancaster, 3s. 10d. Out of the rents of property and profits transferred from municipal undertakings, Darlington relieves the rates to the extent of 1s. 8¾d. in the pound; Wigan, which stood highest last year, following closely with 1s. 7¾d.; Stafford coming next with 1s. 3·8d.; Kingston-upon-Hull with 1s. 3½d.; Macclesfield with 1s. 2½d.; Nottingham with 1s. 2d.; Carlisle with 1s. 1d.; and King's Lynn with 1s. Middlesbrough still occupies the distinguished position of contributing ½d. in the pound in aid of the rates; while Plymouth and South Shields give 1d. each, Devonport gives 1·2d., and Portsmouth 1·5d. The highest net charge per 1000 cubic feet for gas is at King's Lynn and at Norwich, 3s. 6d.; Bournemouth following closely with 3s. 4d.; and Brighton, Chester, Reading, Southampton, South Shields, and Tunbridge Wells charging 3s. Widnes is still conspicuous for being supplied with the lowest-priced gas—the average charge being given by Mr. Carter as 1s. 4d. per 1000 cubic feet; Sunderland and York coming next with 1s. 11d., and Gateshead with 1s. 11·4d. The charge for electricity ranges from 7d. down to as low as 3·3d. (at King's Lynn) per unit. The charge for water for domestic purposes, on a house of £15 rateable value, is highest at Bury and Rochdale, 2s. in the pound; and lowest in Liverpool, 7½d. Leamington and Manchester follow closely with 8d.; Brighton and King's Lynn, with 9d.; and Accrington, Barrow, Bath, Belfast, Brighouse, Burnley, Carlisle, Cheltenham, Eastbourne, Kingston-upon-Hull, Leeds, Preston, Southampton, Stafford, Sunderland, and York, with 1s.

WELSBACH LIGHTING IN AUSTRALASIA.

According to a correspondent of the "Sydney Morning Herald" for the 25th of October, public lighting by the Welsbach system is extending in the Colonies.

He says that the Australasian Incandescent Gaslight Company, Limited, in conjunction with local gas companies, are making great progress throughout Australasia in public lighting, as the undermentioned information indicates. The Melbourne Harbour Trust have decided to substitute incandescent gas-lights for the electric light with which the roads and wharves on the north and south sides of the River Yarra, between the Queen's Bridge and the entrance to the Victoria Dock, are illuminated. The tender of the Metropolitan Gas Company for the work of installing and maintaining the Welsbach lights has been accepted by the Trust. The Wellington Gas Company have provided an object-lesson to the colony of New Zealand as to the possibilities of gas as an *al fresco* illuminant. Whenever the Company have had an opportunity of displaying their large lamps in the streets, the result has been to make a decided impression. But the Company's latest and best score is in connection with harbour lighting. Four months ago, the Harbour Board were induced to allow the patent Welsbach high-power lamps to be fitted up on and about the Queen's Wharf. Some 25 three-light lamps (210-candle power) and 49 two-light lamps (140-candle power) were installed, and the result was an immediate and brilliant success. Burning steadily and brightly in all weathers, these lamps have practically turned night into day wherever they have been located on the wharves and in the storage sheds, at the same time that they have imparted to the harbour a striking appearance, which has invoked favourable criticism on all hands. Travellers entering Wellington, both by train and by the steamer, have found in the harbour lights a spontaneous theme for admiration. On the 17th of October, the Harbour Board, having given the gas illuminant a thorough and exhaustive trial, and being a body who reputedly know a good thing when they see it, decided to entrust to the Wellington Gas Company the lighting of all the wharves, sheds, and premises under their control for the next seven years. The new contract provides for 132 new two-light (140-candle power) lamps, and 24 three-light (210-candle power) lamps. When this installation is completed, Wellington Harbour will probably be the most brilliantly lighted in the Southern Hemisphere. The Municipality of Geelong (Victoria) has accepted a tender for the lighting of its streets by the Welsbach gas system for three years from the 1st of January; and other civic corporations in Australia have made contracts for five years' service under the system.

WALKER ELECTRIC LIGHTING SCHEME.

The remarks of Mr. Justice Farwell, when giving judgment in the case reported in the "JOURNAL" last week (p. 1470), as to how far municipal bodies are justified in entering into competition with private traders, and taking away their customers, have naturally not escaped notice in the district to which they referred. A "Trader" writes thereon to the "Newcastle Daily Chronicle" as follows: "Here is an actual instance of the coercion which your correspondent of the 13th ult. [see *ante*, p. 1326] saw clearly foreshadowed in the report made by the Walker Urban District Council on the position of the electric scheme; and it is a very powerful argument against allowing such work as the supply of electricity to be placed in the hands of municipal authorities. The result in this case is that manufacturers are to be compelled, by any means that are placed at the disposal of the municipal authority, to become their customers for current, though the cost is admittedly higher than that at which it can be bought from private companies. To enable a municipal authority to supply current, a loan is necessary, and this loan is always repayable over a term of years—in this case thirty. For thirty years, therefore, if the desires of the municipal authority are fulfilled, the manufacturers are to employ as their motive power electricity at a cost higher than necessary, without the power of availing themselves of any new discovery which may tend to cheapen electricity or supersede it. Can it be desirable that a municipal body should speculate upon such chances? for speculation it can only be considered, unless they have a gift of prophecy which enables them to say with certainty that no improvement will be made until their loan is repaid. Such a statement would imply an exercise of their coercive rather than their prophetic powers, and would mean that these are to be applied to prevent any improvement which, though it might benefit the trade of the country by reducing the cost of production, would, if it were adopted, take away a source of revenue from the municipal bodies, and throw upon the ratepayers—the unwilling shareholders in an industrial concern—a burden that they should never be called upon to bear. The functions of a governing body, as regards trade, ought to be, shortly, to do those things for the community which private enterprise will not or cannot undertake; and in this case the governing body appears to have greatly exceeded this function. This is evidently the view of Mr. Justice Farwell."

PUBLIC LIGHTING DISPUTE AT KINGSTON.

There has lately been a dispute between the Lighting Committee of the Corporation of Kingston-on-Thames and the Gas Company, on the subject of the terms for the renewal of the contract for the lighting of the public lamps, which expired on the 30th ult. The Company had offered to enter into a contract for three years, at an all-round charge of £3 10s. 6d. per lamp, or the alternative terms for a contract for one year for lighting incandescent lamps at £3 13s., and the ordinary lamps at £3 17s. each. By the instructions of the Committee, the Town Clerk (Mr. H. A. Winser) wrote to the Company to the effect that the Committee could not accept the terms offered. He pointed out that they were in excess of the maximum allowed by the Company's Act of 1900, having regard to the price at present charged by the Company to private consumers. Further, he said it would be found that the present price compared unfavourably with that charged to the Corporation when the private consumers' price was 2s. 11d. The excess appeared still greater when the offer was considered in relation to statements contained in a circular recently issued by the Company to the consumers. The Corporation would be quite prepared to accept this as the basis of the charge for the public lamps—viz., at the rate of 12s. for the burning of a lamp of 50-candle power for 1500 hours. Even with a generous estimate of the quantity of gas consumed by the public lamps, a charge on this basis would work out at considerably less than that proposed by the Company. The Company, in reply, said they could not see their way to a reduction in the terms proposed for a one-year contract. They denied that the figures were in excess of the maximum allowed by their Act of last year. If the terms proposed appeared to the Lighting Committee to compare unfavourably with the prices charged when the private consumers paid 2s. 11d., it was owing to the previous terms for public lighting having been considerably below what could have been justly claimed. With regard to the circular, a comparison could not fairly be instituted between indoor illumination of the description therein referred to (incandescent lighting) and outdoor street lighting. The Directors expressed their desire to sympathetically regard any representation from the Corporation, but regretted that they could not see their way to modify terms which were far more favourable than the Committee evidently believed to be the case. The Town Clerk wrote, in reply, that the Company's answer did not give them any facts which they could place before the Corporation to justify the acceptance of the proposed terms. They failed to apprehend how the quantity of gas consumed by a given burner could appreciably be affected by the circumstance of its burning outdoors rather than indoors. But even after making all allowance for any difference there might be between the two lights, the Committee were still confronted with the serious divergence that existed between the terms of the Company's offer and their published circular. They would, however, be prepared, if the Directors so desired, to further discuss the matter at an interview.

The proceedings so far came before the Corporation in a report presented by the Lighting Committee at a recent meeting of the Council; and Alderman Collings, in moving its adoption, narrated the further progress of the matter. He stated that a deputation had been appointed to meet the Directors of the Company, and the result would be made known. He said as some members of the Corporation might wonder why the Committee had arrived at the point where they now stood, he would try to put before them the exact arguments. The Gas Company had issued a circular stating that a 50-candle power lamp would consume 2¼ cubic feet of gas per hour, and that, at the price charged, 1500 hours of light by a burner of this size could be obtained for 12s. Now, a light of 50-candle power would be equal to

the light given by the street-lamps; and in the face of the circular, the Committee did not see their way to accept the terms offered by the Company to renew their contract, because of the divergence between them and those in the circular. They put the matter fairly before the Directors, and the reply was that the burner passing 2¼ feet was not adapted for external use. The Company stood upon their contract, which was based on a consumption of 4 cubic feet of gas per burner. But even with this quantity, the price did not work out at £3 13s. The Company brought before them an alternative proposal that the Corporation should hand over the whole of the lamps for three years; and for this period they offered better terms. The effect of this would be that during that period the Committee would be unable to carry out the extension of the arc lighting for which they had the consent of the Corporation, and also to adopt electric lighting where they had low-tension cables—thereby reducing the number of gas-lamps from about 600 to 400. The Committee could not, therefore, recommend the acceptance of the offer; and he thought the Council would see that, under the circumstances, the Committee could have taken no other course than that adopted. When the price of gas was 2s. 11d. per 1000 cubic feet, a charge was made of £3 7s. 6d., and a great jump of 10s. 6d. was made because of the increased price of coal, though this was out of proportion to the increase to the private consumers. The Committee at that time recommended the Corporation to seal the contract, as it was only for one year; and they were told that the difference made in the charges to private consumers did not represent fully the increased cost of coal. Now the Committee had expected to be put back to the original price. The report was adopted.

KITSON LAMPS FOR PUBLIC LIGHTING.

Abandonment in Paddington and Marylebone.

The trial of Kitson lamps for public lighting which has lately been going on in Paddington and Marylebone came to an end at the close of last month. At a recent meeting of the Paddington Borough Council, it was reported that on the 19th of March last the Council agreed to allow the Kitson Lighting Company to exhibit their lamps in Oxford and Cambridge Terraces, at their own expense and risk, for a period of 60 days. The Company now expressed their willingness to put up 16 lamps upon the following terms: A payment of £2 10s. for fixing each lamp, a further sum of £12 per lamp for six months' trial, and an additional sum of £2 10s. per lamp in the event of the same being removed at the end of that period. The Electric, Gas, and Water Committee did not think these terms would be to the advantage of the borough; and they recommended that the Company be informed that the Council were not prepared to accept them, and that they be requested to remove the lamps at present erected. This was agreed to; and the Surveyor was instructed to replace the old lamps on the expiration of the contract with the Company on the 30th ult. This matter also came before the Marylebone Borough Council at their meeting on the 28th ult., when the Lighting Committee reported that they had considered an offer from the Kitson Company to furnish a given number of lamps as a minimum, similar to those already supplied, in continuous roads or sections of streets, which might be satisfactory to the Council, upon certain terms. The Committee decided that the Company should be informed that their system of lighting having been given a fair trial, they were not prepared to recommend the Council to adopt it, and that they be called upon to remove at once their lamps and standards.

SALES OF STOCKS AND SHARES.

At the Mart, Tokenhouse Yard, on Monday last week, Mr. Alfred Richards sold, by order of the Directors, £4805 of additional "B" consolidated stock of the Tottenham and Edmonton Gas Company. This stock ranks for a standard dividend of 3½ per cent., subject to the sliding-scale; the last dividend on the existing "B" capital having been at the rate of 4 per cent. per annum. A reduction in the price of gas having been notified to take effect as from the reading of the meter indices at the Christmas quarter, the stock would, by virtue of the sliding-scale, be entitled to a dividend as from Jan. 1, 1902, at the rate of 4½ per cent. per annum, if earned. The prices realized ranged from £100 10s. to £101 per £100 of stock—an average of £100 13s. 10d., yielding the investor £3 19s. 6d. per cent. On the same occasion, Mr. Richards offered for sale, in accordance with instructions received from the Directors, shares and stock of the Southend Water and Witney Gas Companies. New £10 fully-paid ordinary shares in the former Company, carrying 5 per cent. dividend, fetched £12 and £12 2s. 6d. each; and some 4 per cent. perpetual debenture stock was sold at £112 per £100 of stock. The Witney Company offered 156 shares of £5 each (dividend for the last two years 5 per cent. per annum), and they fetched from £4 to £4 10s. apiece—an average of £4 6s. 4d., yielding £5 15s. 9d. per cent. A small parcel of original £5 shares in the West Ham Gas Company (last dividend 9 per cent) were sold for £10 2s. 6d. each; and some ordinary shares of similar nominal value (last dividend 6 per cent.), at £13 2s. 6d. each. Last Tuesday, Mr. J. T. Reed (of Messrs. Vasey and Reed) offered for public competition, at the offices of the South Shields Gas Company, in £100 lots, £8000 of the Company's new stock, which fetched from £165 to £173 5s. each. At the Mart on Wednesday, Messrs. Fox and Bousfield sold parts of a King's freehold share in the New River Company at the average rate of £94,580 per share. They also sold some £10 "A" shares in the Sevenoaks Gas Company at £18 10s. each.

The Water Committee of the Cardiff Corporation have decided to engage Mr. J. A. B. Williams, of Bournemouth, formerly Water Engineer to the Corporation, to report, in conjunction with the present Engineer (Mr. C. H. Priestley, Assoc.M.Inst.C.E.), on the subject of constructing an additional reservoir in the Taff Fawr Valley.

GAS v. ELECTRIC LIGHTING IN FOG.

The Lighting in the Parks.

Last Wednesday London had another visit from what is now commonly called the "Fog Fiend." Early in the day it seemed to have descended somewhat irregularly; for while certain places were enveloped, others almost contiguous were practically free. Later on, however, the City was enshrouded in the darkness of night, to the great impediment of both pedestrian and vehicular traffic. As was the case with the fogs of last month, this latest visitation afforded the incandescent system of gas lighting an opportunity of outshining its professedly more brilliant competitor. For the most part the fog on Wednesday remained above the houses; but where it descended, the electric lights were soon lost. Discoursing upon this subject, a writer in the "Daily Telegraph" on Thursday remarked as follows: "The superiority of the incandescent gas system has been proved in other ways; and the experience of the State in lighting the Royal Parks may be cited. It is not generally known that Colonel Wheatley, the Bailiff, has given the closest attention to this question from the practical standpoint. His opinion in favour of incandescent gas is very strong; and he speaks with a full knowledge of the two illuminants. For the lighting of St. James's, the Green, and Hyde Parks, the estimates for the present year are: Gas, £2055; electricity, £425. Electric arc lamps provide a very good light upon the Horse Guards' Parade, and in certain parts of Hyde Park where it is desirable to light a wide area around each lamp. But the practice is to place incandescent gas-lamps in pathways and more confined spaces. The whole of St. James's Park is lighted with gas, and the greater portion of Hyde Park likewise. Probably the latest form of lamp is the self-intensifying shadowless one, which may be seen on the refuge in the Mall, going towards Buckingham Palace from Marlborough Gate. In the same road there is a duplex incandescent; and in other parts of the parks almost every variety of burner with the incandescent mantle can be found—some of them burning all night. Taken generally, the St. James's Park lighting gives the most satisfaction. Its cost is defrayed by an annual charge per lamp, the Gas Company maintaining the mantles; whereas in Hyde Park the gas consumed is paid for by meter, and a number of men are kept to renew the mantles. As Hyde Park closes at midnight, the lights are then all turned out. Colonel Wheatley is of opinion that to produce the same amount of light with electricity as with gas costs twice as much, taking the price at 4d. per unit. Gas-lamps are, he says, always placed in line; but electric standards are sometimes in the middle of the road, or on this side or that, and it is difficult to tell where they are. As incandescent gas-lamps are lower and closer together, one can always see from one lamp to the other. Even in the record fog of November, when all was confusion in streets lighted with electric lamps, little trouble was experienced in St. James's Park, where the incandescent gas-lamps were burning. Last Wednesday's observations confirm this view; for it was lighter in the park, where fog was drawn to the surface of the water of the lake, than in St. James's Street, where throughout the day the electric lamps were aglow."

ELECTRIC LIGHTING NOTES.

The Local Government Board have just sanctioned a loan of £31,100 for the extension of the electric lighting works of the Middlesbrough Corporation.

A Local Government Board inquiry was held at Morecambe last Tuesday, relative to an application by the Town Council for sanction to borrow a further sum of £5000 for electric light purposes. The Council have already expended £60,000 on the installation. There was no opposition.

Under the heading "Electric Light and Chinese Lanterns," the "Westminster Gazette" last Thursday week contained the following amusing paragraph: "Croydonians, having abandoned gas and adopted electricity for street lighting throughout the main road from Norbury to Purley, have been enjoying during the last few evenings the delightful uncertainties of their new illuminating medium. On Tuesday evening the Brighton road was in total darkness; and the strange spectacle was seen of Corporation servants carrying Chinese lanterns lighted with the orthodox candles, and with these ancient illuminants examining the arc lamps along the road. On Wednesday evening a partial lighting was effected, but it was very partial indeed. The same thing happened temporarily once or twice during the recent fogs."

The electricity undertaking of the Bedford Corporation is now entering on its seventh year; but Mr. Royle, the Chairman of the Electric Lighting Committee, told the Council on Wednesday that, after going through the accounts, he was sorry to be unable to hold out any hope that in the near future the venture was going to pay. They had to make at least £4000 a year, besides working expenses, before they would begin to see any profit; and this was a colossal task. The concern was absolutely over-capitalized. Upwards of £1000 worth of machinery had become obsolete, and fit only for the scrap-heap. The more he saw of their new Engineer (Mr. Phillips), the more he liked him; and he believed he would do all in his power to help them to make the undertaking pay. A discussion followed as to who was responsible for laying the straggling mains in different parts of the town. The Town Clerk contended that it was done by order of the Committee.

Complaints are being renewed in regard to the inefficiency of the electric lighting at the Royal Courts of Justice. We learn from "The Times" that, in consequence of the darkness of the atmosphere last Wednesday, and the very inadequate lighting of the Appeal Court, great inconvenience was experienced by the Bar, especially by those who were engaged in the work of reporting. Indeed, Lord Justice Vaughan Williams, when calling on one of the King's Counsel at the time of *ex parte* motions, said he could hear the learned gentleman, though he was unable to see him. Hope is expressed that advantage will be taken of the approaching Christmas vacation to effect some improvement in the lighting arrangements, which for a long time have

proved to be very inefficient. So far as appears, there would be no difficulty (other than that of the expense) in increasing the number of the electric lamps. A cluster of lamps suspended from the centre of the roof of the Court is suggested as a valuable addition.

At the meeting of the Loughborough Town Council on Monday last week, the Gas Committee reported that, in accordance with instructions, they had taken into consideration the question of establishing an electricity supply undertaking for the borough, and had obtained expert advice upon the matter. They had secured the services of Mr. T. L. Miller, of Liverpool, whose report practically confirmed in all respects the one made in 1898 by Mr. C. H. Gadsby. They recommended as follows: (1) That the Town Council should themselves exercise the electrical powers vested in the Corporation; (2) that they should confer upon the Gas Committee the duties and powers necessary to enable them to establish an electrical undertaking; and (3) that they should appoint Mr. C. H. Gadsby, subject to satisfactory terms being arranged, as Engineer for carrying out the works. The recommendations were discussed at some length; an opinion being expressed that the control of the undertaking should be entrusted to a separate Committee. Eventually, however, they were all agreed to.

The St. Helens Town Council do not seem to be altogether pleased with the change which they have made from gas to electricity for the lighting of the principal streets. At last Wednesday's meeting of the Council, Mr. Brown said that the result was exceedingly unsatisfactory; the lights could not be depended upon. Alderman Cook was not prepared to say that the electric lighting of the streets had been perfect. The matter had been several times before the Committee. They did not like to take any extravagant measures; but if they found the lighting was not improved in the course of a short time, the Committee must consider as to whether the electric lights should be removed, and gas-lights put in their place. (Hear, hear.) Alderman Beecham (the Chairman of the Electricity Committee) said the Committee decided some time ago to purchase pillar-boxes in which to place the joint-boxes, which had given trouble by reason of water having got into the cables. Very great delay had occurred in the supply of these bases; but when they were fixed, he believed all cause of complaint would be removed. Councillor Grundy said the arc lamps had been in a deplorable state the last two or three weeks. The minutes were adopted.

Some discussion took place at last week's meeting of the Hull City Council, with reference to a proposal of the Electric Lighting Committee to supply current to a certain firm for power purposes at 1d. per unit, providing 500,000 units were used. Dr. Holder thought the Committee had not proved that the current could be produced at the price, to which the Electrical Engineer replied that it did not cost quite 1d. per unit. This, however, was without reckoning rents, rates, and taxes, which would make the cost slightly over 1d. Dr. Holder pointed out that in Bradford the cost was only ½d. per unit; but in Hull the works cost was 1·98d., and the cost delivered was 2·52d. How then, he asked, were they going to sell the current at 1d. per unit, as had been proposed by the Committee? Supposing the firm in question were employing 3000 men, and there was a breakdown at the power station, would they come upon the Council for damages? Alderman Seaton said he was afraid that before they could enter into contracts to supply electric power, they would have to provide additional plant. Several other members suggested that the matter should be referred back; but, in the end, the minutes were adopted.

Last Tuesday evening, the power station at Lower Penarth, for the supply of electrical energy to the town, was formally opened by the Chairman of the District Council (Mr. D. Morgan) switching on the permanent supply of current. At the invitation of Mr. George Offor, the Parliamentary Secretary of the Electrical Power Distribution Company, Limited, the members of the Council met at the station, over which they were shown. Mr. Offor thanked the Chairman, and said the whole of the work in the station was of British manufacture. He should like to congratulate the Council upon their declining to go into the business as a speculation, as a great many other bodies had done. He need not go farther than their great neighbour—Cardiff—for an example of trading in electricity. There were certainly not more than three towns that could show a genuine balance on the right side. In all the cases where a surplus was shown, they would find one thing absent in the accounts—no allowance was made for depreciation of plant. Take Cardiff. In four years their loss had been more than £9000. They had provided nothing for depreciation, which in Glasgow was placed at 4 per cent. on the capital outlay. Cardiff had perhaps newer plant. Putting the depreciation at 3 per cent., this would make another £9000; so that the net result was a loss of £18,000, which the Cardiff ratepayers had to pay for their speculation in electricity.

The decision of the Electricity Committee of the Manchester Corporation to place the contract for the machinery required for the extension of the Stuart Street station with a German Company, gave rise to some discussion at the meeting of the City Council last Wednesday. When moving the adoption of the Committee's proceedings containing a recommendation that the tender of the Electrical Company, Limited, for the supply of the necessary plant should be accepted, Dr. Bishop remarked that there appeared to be an impression that the Committee were giving out more foreign orders. It was nothing of the sort. The engines in the tender were required for the extension of plant which had been designed by their own Engineer (Mr. Metzger), in addition to work going on under the supervision of Dr. Kennedy, in order to have certain portions prepared in time for next winter's load. As regarded the price for the plant, he wished to say at once that the Committee had not shown favour to any particular company. The tender the Committee recommended the Council to accept was £36,000 less than the lowest British tender; and he thought they would agree that the Committee could do nothing less than place it where they had. Had it been a matter of a difference of £2000 or even £3000, he did not suppose the Electricity Committee would have hesitated in preferring home manufacture; but they could not for a moment consider a home tender which was £36,000 higher than the one they had accepted. It would be bound to affect, in the long run, the price at which the current was supplied. It was to be remembered also that this particular firm had already manufactured plant of similar capacity, which could be seen in operation; whereas there was no instance in this country at the present time of such work by a British manufacturer, nor could it be supplied in the time necessary. Mr. Lambert raised the questions of whether the Committee were justified in placing a large contract with a German firm, and whether the Westinghouse Company were regarded as a foreign or an English Company, because their tender was only £16,547 higher than the successful one. If the Committee accepted the tender of the Westinghouse Company, it did not mean the loss of £16,000, because a very large portion of the money would be turned over in Manchester for the benefit of the citizens. But what benefit would the contract be to the people of this country if it went to Germany? None whatever. He therefore submitted that the Council ought to show some consideration for English firms. He moved, as an amendment, that the matter be referred back to the Committee for further consideration. Alderman Stanley seconded the amendment. After some discussion, Dr. Bishop said it had been argued that, as the Westinghouse Company was a British firm, therefore the Committee ought to support that firm by spending £16,000 more in connection with the tender. He challenged the statement of Mr. Lambert that if the tender were let to the Westinghouse Company part of the work would be done in this country. The important work would be done at Pittsburg. Moreover, their tender was for rotary converters—a type of generator altogether different from that which the Committee required, and for which they had specified—for a generator which, in short, they could not have accepted as a gift, because it could not have been worked in conjunction with the existing plant. On being put to the vote, the amendment was lost, and the Committee's proceedings were adopted.

Since the failure of the electric light at Bath on the 18th ult. (which was noticed in the "JOURNAL"), the public lighting has been only partial; but the incandescent service had been almost completely restored. Last Wednesday week, however, there was another breakdown of both public and private electric lighting. This was stated to be due to the new switch-board (to which the cables had been connected since the first failure) having been fused. The calamity caused widespread complaint; "but," says the "Bristol Times," "as the electric lighting of the city has never been of the most satisfactory nature, the inhabitants have become accustomed to its vagaries." A report has since been submitted by Mr. J. W. Gatehouse, Electric Light Inspector under the Board of Trade, to the Surveying Committee, in which it is stated that there were three causes of the disasters of the past fortnight. First, the old mains laid by Mr. Massingham some twelve years since had evidently become unsuited to carry the load and pressure now frequently put upon them. In this connection, it might be noticed that the cables were carried on wooden supports in grooves; and if these grooves pinched the plastic insulation—either from the wood being made wet or from the expansion of the copper core of the cable by being overheated, as was reported to have been the case in certain circuits last winter—then the insulation was weakened and a little extra warming or a higher pressure than usual would break it down. Secondly, the failure of the old and new switch-boards. Thirdly, the abnormal heating of the most important alternators, combined with the impossibility of using the new switch-board in the manner in which it was intended. There was some discussion, one member suggesting that gas-lamps should be fixed to some of the electric light standards; but no action was taken on the report. This was followed by a meeting of the City Council on Tuesday last, when a deputation of citizens attended to complain of the electric light failures. Mr. A. J. King, who acted as spokesman, concluded a heavy indictment of the management of the concern, by urging the Council to restore public confidence by a statement as to how much money had been wasted, or whether it had been spent properly, and what was the best thing to be done with the works. He wished to assert solemnly that no report which came from the Electric Lighting Committee would meet the exigencies of the case. The report, to be accepted by the citizens, must be separate from that Committee. If this were the result of their deputation, the citizens would feel that their earnest remonstrances had not been without effect, and that they might in time have an electrical system which would be a credit to the city instead of a disgrace. On the withdrawal of the deputation, a long and stormy discussion took place. When the Selection Committee's report was being considered, and the re election of the Electric Light Committee was proposed, Mr. Moger moved the following amendment: "That the recommendation of the Selection Committee with reference to the appointment of the Electric Lighting Committee be not adopted. And having regard to the recent disastrous breakdowns of the electric light undertaking, entailing as they did considerable inconvenience and danger to the public, and also to private consumers, it is desirable that at present the whole Council should sit as an Electric Lighting Committee; and that the meeting of the Council as the Electric Lighting Committee be not open to the Press." The amendment was carried by 28 votes to 8. The first meeting of the Corporation, sitting in private, in accordance with this decision, as a Committee managing the electric light undertaking, was held on Wednesday, when two Sub-Committees were appointed. The most important was an Inquiry Committee, who are to investigate the past history of the concern, and report as to its future working, with information as to the amount of money required to put the undertaking into a thoroughly sound condition. The six members appointed on the Committee were none of them connected with the old Electric Light Committee. The second Committee was a Management Committee to carry on the works.

New Gas-Works at Konigsburg.—The inhabitants of the town of Königsburg, in Prussia, each consume 50 cubic metres (1765 cubic feet) of gas per annum, which necessitates an annual production of about 9½ million cubic metres, or 336 million cubic feet. The old plant, which was found insufficient, has been altered, and the improvements have been described in the "Zeitschrift des Vereines deutscher Ingenieure." The Königsburg gas-works occupy a site of 30 acres; 2 acres being utilized for the coke-store. The space covered is therefore only 10 hectares, or only about half the ordinary area. The furnaces are built with 9 inclined retorts, 12 feet long, each containing 550 lbs. of coal. The aërial conveyors carry in 10 hours the raw material necessary for 24 hours' work. There are two gasholders with a capacity equal to 50 per cent. of the daily production. Each will hold about 1¾ million cubic feet.

INCREASED WATER STORAGE FOR HEYWOOD.

In the "JOURNAL" last week, it was briefly recorded that, by the completion of works in connection with the Naden Higher Reservoir, the storage power of the Heywood and Middleton Water Board had been considerably increased. The reservoir has been filling for several weeks past, and on the 26th ult. the water reached its highest point, and the surplus began to pass, by way of the newly-constructed masonry overflow, into the lower reservoir in the Naden Valley. Not only has the old embankment been greatly strengthened and repaired, but it has now been raised to store an additional 8 feet of water; and the capacity of the reservoir has been increased from 55 to 80 million gallons. In all respects the reservoir presents the appearance of a new one; and the whole of the works have been carried out in a very substantial manner, at a cost of about £43,000, by workmen employed directly by the Water Board, under the supervision of their Engineer, Mr. J. Diggle, Assoc.M.Inst.C.E., and his staff of assistants. As mentioned last week, the higher reservoir has been a constant source of anxiety ever since it was constructed in 1848 by the late Water Company, on account of the sliding tendency of a portion of the embankment; and during the past fifty years numerous experts (including the late Mr. Thomas Hawksley and Sir J. F. Bateman) were called in to advise the Company as to the means to be adopted to arrest movement. The embankment has now been greatly strengthened by the addition of a large quantity of material, and also the construction of a huge concrete retaining wall, in the outer portion of the old embankment. This wall, which is 20 feet thick, extends entirely across the valley (a distance of 620 feet); having been carried down to a good shale foundation throughout its entire length. In sinking the deep trench for the retaining wall, a large quantity of timber had to be used to support the old embankment during the progress of the work. The excavation proved that there exists a considerable depth of glacial deposit in the Naden Valley, and that the bottom of the original valley is about 60 feet lower than that of the existing one. In sinking to the shale foundation, two beds of strong blue glacial clay were cut through, as well as one bed of finely laminated clay (generally known as book-leaf marl) and three beds of sand and gravel, charged with water. Under the bottom bed of gravel, the original stream or brook course was met with, at a depth of about 60 feet below the surface. From an engineering point of view, the work has been a very difficult one to accomplish; and during the 3½ years in which it has been in progress, the reservoir has been continually in use. This is the second reservoir in the valley which has been enlarged under the direction of Mr. Diggle; the capacity of the middle reservoir having previously been increased from 57 to 150 million gallons, and an entirely new reservoir constructed at Clay Lane, with a capacity of 75 million gallons.

The Town Council of Johannesburg are asking for tenders for a complete carburetted water-gas plant of a capacity of 300,000 cubic feet per diem. The estimated cost of the plant is not to exceed £15,000.

TEIGNMOUTH WATER SUPPLY.

The question of the water supply was again under the consideration of the Teignmouth District Council last Tuesday, Letters and memorials were read in reference to the schemes for obtaining supplies from Paignton and Widdecombe-in-the-Moor. Mr. Harris, the Chairman of the Water Committee, said that a deputation had waited on the Committee with reference to the Paignton scheme, and urged that there was no immediate hurry for going into the matter, as the supply had been better this last summer than it usually was. Taking the whole of the twelve months, it appeared that they had had 1,705,000 gallons more than in the year before. Mr. Banbury thought the figures misleading. Last year the pumps were worked to their full capacity; and yet they were supposed to have yielded more this year. The Surveyor, answering a question, said the water was now turned on from 7.30 a.m. to 12 noon. During this year the supply had been better, though the rainfall had been much lower. The Rev. A. Cartwright thought it important that the matter should be settled, and moved that, upon receipt of the draft agreement with the Torquay Town Council, steps should be taken to give effect to it. The meetings of ratepayers favouring different schemes were simply farcical, and were doing the town injury. If it should happen that they were unable to come to terms with Torquay, then they could consider the other proposals; but they could not enter into negotiations with other people while they were engaged with Torquay. The resolution was carried with one dissentient—the Chairman of the Water Committee. It was decided to inform the authors of the letters and memorials of the Council's position and resolution.

Dispute as to the Removal of Lamp-Posts at Rathmines.—Negotiations have lately been going on between the Rathmines and Rathgar Urban District Council and the Alliance and Dublin Gas Company concerning the removal of a number of their lamp-posts from the footpaths in the townships; and at the meeting of the Council last Wednesday, it was stated that a writ had been issued to compel the Company to take away the posts. Several members expressed surprise at hearing of the issue of the writ. They disclaimed any knowledge that the Council had directed such a course. Mr. Bolton, Chairman of the Electric Lighting Committee, explained that the matter had been fully considered by the Committee. The expense of removing all the lamp-posts would be very heavy; and as negotiations for an arrangement with the Company as to the payment of a portion of the expense of restoring the condition of the pathways had not been successful it was found necessary to recommend legal proceedings. The Committee had obtained legal advice to the effect that the Council would not be bound to carry out the work of removing the posts. It was decided to refer the matter back to the Committee, in order that the Company might be approached to ascertain on what terms a friendly arrangement could be arrived at. Mr. Bolton said the feeling of the Committee was in favour of preserving friendly relations with the Company.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Town Council of Aberdeen on Monday considered the recommendation of the Gas and Electricity Committee to appoint Mr. Samuel Milne to be Assistant-Engineer in the gas-works. Mr. Milne has been connected with the gas-works for ten years; and he has, in addition to his ordinary duties, been employed to prepare the plans and specifications for the electricity stations in Cotton Street and at Ferryhill. The Committee also took into consideration the increasing value of the gas undertaking, the revenue of which last year was £113,000. In laying the proposal before the Council, Mr. Kemp, the Convener of the Committee, said that Mr. Milne had given admirable service to the Corporation, and he had taken charge of the works in the absence of Mr. Smith. It was in the interest of the Council that they should have someone who was capable of undertaking the charge of the works. There was opposition to the proposal. Mr. Gray thought that the salary of Mr. Milne should not be increased as proposed from £130 to £200 a year, when they did not treat the ordinary gas workers in a similar way. Various speakers expressed the view that Mr. Milne had conducted the gas undertaking most capably during the absence of Mr. Smith. It was also pointed out that in fees alone Mr. Milne had saved the Corporation not less than £1000, by his work upon the plans for the electric light stations. The appointment was made by 29 votes to 4. The reasoning of Mr. Gray, if it be not what is usually termed "in a circle," was clearly "within" a circle, and that a very narrow one. He failed to realize that the gas workers did not get a rise in wages for the reason that they already receive pay equal to that which is received by workmen in the same grade as themselves; whereas Mr. Milne has been doing work which, had another been employed to do it, would have cost the Corporation far more than is to be spent in this increase of salary. But it is out of the question to expect certain members of Corporations—Aberdeen and others—to keep silence when an opportunity occurs of saying something which will be pleasing to the working class.

The Town Council of Inverness were this week moved to rescind a resolution formerly adopted, and to resolve that all the streets in the town, whether public or private, should be lighted at the public expense. There are, it was stated, 18 roads which are unlit; and the number of lamps which would be required is 46. The original cost would be £115, and the maintenance £60 a year. A discussion took place upon the proposal, in the course of which it was stated that there is an action in dependence in the Sheriff Court, the object of which is to compel the Town Council to light private streets. On account of the question of the Council's liability being under judicial consideration, some of the members declined to support the proposal which was now made. It was consequently lost by 11 votes to 6. It seems that the terms of the feu charters are supposed by some people to affect the question. These terms can only be of private effect—that is, as between the superior and his feuars—and can have no bearing upon the question of whether streets which are still private are to be lighted or not. Lighting is a police provision, and whenever a street or a road comes to be used by the public, whether its maintenance be assumed by the corporation or not, it ought to be lighted by the municipality, and the cost taken out of the rates which are imposed for police purposes.

At the same meeting, the Council resolved that the suburb of Clachnaharry, which is on the opposite side of the Caledonian Canal from the town, shall be lighted by gas. The question of how to light this place has been under consideration for about two years. The first proposal was to have gas; but to some minds there was difficulty in getting a gas-pipe across the canal, and the Council considered the alternative methods of oil and electricity. They have come back to gas as being, in all respects, the best. The cost of laying the main will be £241.

The "Glasgow Herald" of yesterday (Friday) contains the following interesting statements regarding the position of the coal trade: "At a meeting of the Scottish coal exporters held in Glasgow on the 4th inst., the Directors had under consideration the question of the tax on export coal; and it was resolved to continue the agitation for its repeal, and to co-operate with other District Committees for this purpose. A comparison of opinion received by the various Directors with regard to the prospects of trade for 1902, showed that there is a practically universal impression that the coal tax will greatly reduce the exports to the districts supplied by French, Belgian, Westphalian, Silesian, and Bohemian coal, unless prices in this country are so reduced as to cause the duty to fall upon the producers here. It was pointed out that the Westphalian Coal Syndicate have again further restricted their output, with the result that an expansion could take place at any moment in their production equal to 10 million tons per annum, or one-fourth of the total exports of the United Kingdom." Mr. H. W. Heidmann, of Hamburg, writing to the Editor of the "Herald" on Dec. 2, says: "The imports of coal into Hamburg during November have been as follows:—

	1901. Tons.	1900. Tons.
From Northumberland and Durham	108,367	112,287
,, the Midlands	41,606	42,353
,, Scotland	62,493	68,040
,, Wales	9,448	23,812
Coke	1,513	1,466
	223,427	247,958
From Westphalia	165,487	138,231
,, America	7,227	—
Total	395,141	386,189

These figures show again the increase in the imports of coal from Germany and America at the expense of the English producer. The Westphalian Syndicate now publish the new prices for next year. Household coals are unchanged, as they want to see what sort of weather the winter will bring. All coals for steam-raising purposes will be 1s. to 2s. per ton cheaper on contract from April 1; coke, 3s. 6d.

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per ton, beginning on Jan. 1. The output in Westphalia was restricted by order of the Syndicate by 16¾ per cent. in October; and a further reduction up to 20 per cent. is proposed. This means that, with the existing facilities, the Syndicate could produce fully 10 million tons a year more than they actually do. These quantities, therefore, are free to compete with British produce; and it is easy to foresee what result this state of affairs will have on the coal business of our place, considering that prices are high, comparatively speaking, in your country, and export coal is further handicapped by 1s. per ton duty."

Rain is still much wanted in the south-east of Scotland; but it is satisfactory to know that water supplies are improving. The fortnightly statement regarding the water supply of Edinburgh shows that the stock of water in the reservoirs on the 3rd inst. was 1,646,102,000 gallons, which was an increase on the two weeks of 293,106,000 gallons. As compared with the water stored last December, the quantity is still deficient. At the corresponding date last year, there was in the reservoirs 2,578,762,000 gallons, or 932,660,000 gallons more water than at present.

At a meeting of the Town Council of Edinburgh, on Tuesday last, Treasurer Cranston and Mr. Gulland submitted their resignations as representatives of the Council on the Water Trust, each of them with a view to the Council electing in his stead ex-Bailie Archibald, who had been practically dismissed by the Town Council of Leith. The resignation of Treasurer Cranston was not accepted, but that of Mr. Gulland was; and the vacancy is to be filled up at the next meeting of the Council.

At a meeting of the Works Committee of the Edinburgh and District Water Trust yesterday, Mr. G. H. Hill, M.Inst.C.E., who has just made a special examination of the new Talla Water-Works, reported that, in his opinion, unless exceptional circumstances arose, the new works should be completed in from two to three years. The greatest difficulty the Contractors had was to get men. Even if they were to raise the wages, the relief obtained would be only temporary, because a similar rise would take place over the whole country, and matters would again be where they started.

The Gas, Water, and General Investment Trust, Limited, announces that Mr. William H. Morrison has been elected a Director to fill the vacancy caused by the death of Mr. Reginald Ryley.

Simultaneously with the close of the past month, the works of the Weardale Steel, Coal, and Coke Company at Tudhoe came practically to a standstill, after having been in almost continuous operation since 1853. With the exception of the two large blast-furnaces, which, it is understood, will continue to be worked, and two small mills which in all probability will be kept going for a short time, in order to clear up the scrap, &c., work in all other departments connected with the huge concern has ceased, and 1000 men have been paid off. For nearly half-a-century the Weardale Company's products have been of world-wide reputation; and it is somewhat difficult to believe that in the immediate future Weardale steel will cease to exist as a marketable commodity.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 7.

Sulphate of Ammonia.—There has been a very quiet market at all points; and the business done has been on a limited scale at declining prices. The closing quotations are £10 17s. 6d. per ton f.o.b. Hull, and £10 17s. 6d. to £10 18s. 9d. per ton f.o.b. Liverpool and Leith; but buyers are holding off for the chance of doing better. Production is approaching its maximum, and speculators, bearing this in mind, have ventured to offer abroad at and below prompt prices, December-January delivery, while consumers, observing this, have become indifferent. For delivery over the spring months, makers' quotations are unchanged, and, these being above buyers' ideas, business has not resulted.

Nitrate of Soda is firm at 9s. 3d. to 9s. 4½d. per cwt., according to quality, on spot. Holders of cargoes afloat maintain a firm attitude, being supported by a strong statistical position; but there has been retail selling at about spot price for spring delivery.

LONDON, *Dec.* 7.

Tar Products.—Pitch continues very firm indeed; and there is great difficulty in obtaining supplies, especially in London, as all the makers appear to be fully sold up to the end of the year, and in many instances will have nothing to spare before the end of April next. Business is very brisk in South Wales. A large quantity has been placed all over next year, while for January-June a very high price is reported to have been paid for a considerable quantity. 90 per cent. benzol is firmer, with a very good demand for forward delivery. Business is reported at 11½d. for December-January, while this price was declined for January-June by one of the largest London makers. In 50-90 per cent., there is not much business doing. Consumers are open to contract at 9½d., but at present makers will not accept this price, preferring to sell spot parcels from time to time as made. Carbolic continues steady; and there is a fairly good business doing. Some quantity of 50's has again been sold at 1s. 7½d. for December-March, while a large business has been done in 60's at 1s. 11d. all over 1902. As regards crystals, 34-35's continue very firm; but 39-40's are neglected, and the price appears to be rather easier. Creosote continues firm in London; but in the Provinces the demand is scarcely so good. As, however, one or two of the large railway companies are inviting tenders for a considerable quantity, it is possible that prices may harden during next month. As regards anthracene, business is reported in 45 per cent. best quality at 2¾d. per unit, for delivery all over next year. "B" qualities, 30-35 per cent., are offering at 1¼d., early delivery; but consumers will not entertain same. It will therefore be very difficult to place the various parcels of this low quality which are at present offering. Tar remains in the same position, nothing of any importance having taken place during the past week.

The average values obtaining during the week are: Tar, 15s. to 18s. Pitch, east coast, 35s. 6d. to 36s.; London, 37s. 6d.; west coast, 34s. to 34s. 6d. Benzol, 90's, 11d. to 11½d.; 50's, 9½d. Toluol, 10d.

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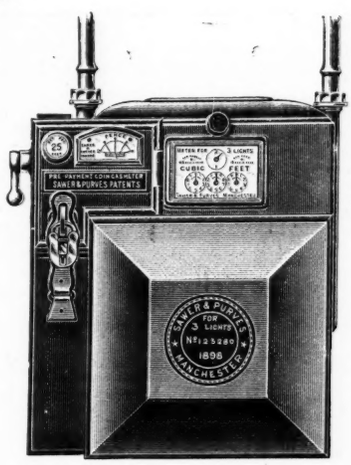

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Sulphate of Ammonia.—The market is decidedly quiet; and the demand for prompt delivery is not so good. The Gaslight and Coke Company maintain their quotation of £11 5s. for January-June, but consumers will not entertain business at this price. In Hull sales have been made at £11 for prompt shipment, but only for small quantities. In Leith there is no business of importance to report. Makers still ask £11, but consumers will not pay more than £10 17s. 6d., or at most £10 18s. 9d. for early shipment. The Liverpool market remains steady. There is nothing of moment to report; but there is a fairly good demand for January-February.

COAL TRADE REPORTS.

Lancashire Coal Trade.—Business, taking it all through, continues to move on steadily, with prices firm at full rates for all descriptions of fuel except the inferior sorts of slack. House-fire coals are moving away moderately well, and collieries have no difficulty in disposing of their present output. There is, however, an absence of any real pressure of demand; and stocks are not being drawn upon to any appreciable extent generally. Prices are firm at the full list rates—averaging 15s. per ton at the pit for best Wigan Arley, 13s. to 13s. 6d. for Pemberton four-feet and seconds Arley, and 11s. to 11s. 6d. for ordinary house-fire coals. Common round coals are in fair request; and as the surplus supplies of these are restricted owing to the increased demand for house-fire and gas-making requirements, collieries have nothing to push upon the market. Prices, however, owing no doubt to the unsatisfactory outlook in many of the large iron-using industries, are not more than maintained at recent quotations; 9s. to 9s. 6d. per ton at the pit being full average figures for steam and forge coals. Lancashire collieries have no difficulty in disposing of all their output of best engine fuel, and in some cases continue short of supplies to meet full requirements. Prices are strong; but the situation does not justify any upward move, and 7s. to 7s. 6d. per ton are about the average quotations. The lower qualities of slack are still plentiful on the market, owing to large surplus quantities being offered from other districts. Prices remain low; 5s. 6d. to 6s. per ton being about the average selling rates for common Lancashire slack, with Derbyshire slack obtainable, according to quality, from about 2s. to 4s. at the pit, and Staffordshire slack also easier. Shipping is fairly good, with 10s. 3d. to 10s. 6d. per ton delivered at the ports on the Mersey still quoted for steam coal. A steady business comes forward in the coke trade; and makers are moving off their present production fairly well. List rates are maintained at about 22s. to 24s. per ton for best Lancashire foundry cokes, and 14s. to 15s. for best washed furnace cokes, at the ovens.

Northern Coal Trade.—There is a very strong demand for coals shown in the last few days, and with rather better working and a good supply of steamers, the shipments have been very heavy—much above the average of late. Best Northumbrian steam coals are rather firmer, at about 11s. 6d. per ton f.o.b. More steam coals are being sold in the unscreened state at about 9s. to 9s. 3d.; while steam smalls are 6s. Gas coals are scarce. There is a strong demand, both on contract and for occasional supplies. The production seems to be better this month; and thus there are very heavy deliveries being made. It is probable that the shipments of the last few days have been above those of any corresponding period, for there is being made up the shortness of supply which arose through the recent storms. The price of the best Durham gas coals varies from 12s. to 12s. 6d. per ton f.o.b., according to quality; while the fact that some of the large producers of gas coals have sold a considerable portion of their output, makes them inclined to ask higher prices for contracts ahead, so that from 9s. 6d. to 10s. per ton is at present the f.o.b. quotation. One large producer of best gas coals cannot now deliver until the spring; his output being sold for over three months ahead. The coke trade is active, and prices are generally firm. Best Durham coke is steady at 18s. per ton f.o.b.; 17s. per ton for blast-furnace coke at the Tees-side furnaces is quoted; while gas coke is in large supply and may be said to be easy at 13s. per ton f.o.b.

Scotch Coal Trade.—The same conditions prevail, except that there is a disposition, common at this season of the year on the part of users of coal, to stock, in order to make sure of having sufficient to carry them over the time when the miners are idle at the New Year. The output, also, is not quite so strong as it was. Both these influences should have raised prices; but any alteration has been infinitesimal. Coalowners are waiting to see how events turn out in Wales, and are reluctant to let down prices, which they might have to raise again immediately. This has a weakening effect on the market; and were it not for pressure to fulfil contracts which are about to expire, the export of coal would go down more than it has done. The prices quoted are: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. 6d. to 11s. 6d., and splint 11s. to 11s. 3d. The shipments for the week were 196,909 tons—an increase of 10,067 tons upon the previous week, and of 1052 tons upon the corresponding week of last year. For the year to date, the total shipments have been 9,135,271 tons—a decrease of 1,034,585 tons for the same period of the previous year.

At the recent meeting of the Wakefield Tradesmen's Association, the Corporation Water Engineer (Mr. C. C. Smith) alluded to the plight in which some towns found themselves owing to the scarcity of water during the late drought, and called attention to the foresight of the Wakefield Corporation in past years with regard to their waterworks. He remarked that sometimes engineers were blamed for recommending what they considered to be too elaborate schemes; but they were generally prepared with a view to the future. If many of the larger towns had acted upon the advice of their engineers in years gone by, they would not have been in the awkward position in which they had been placed this summer.

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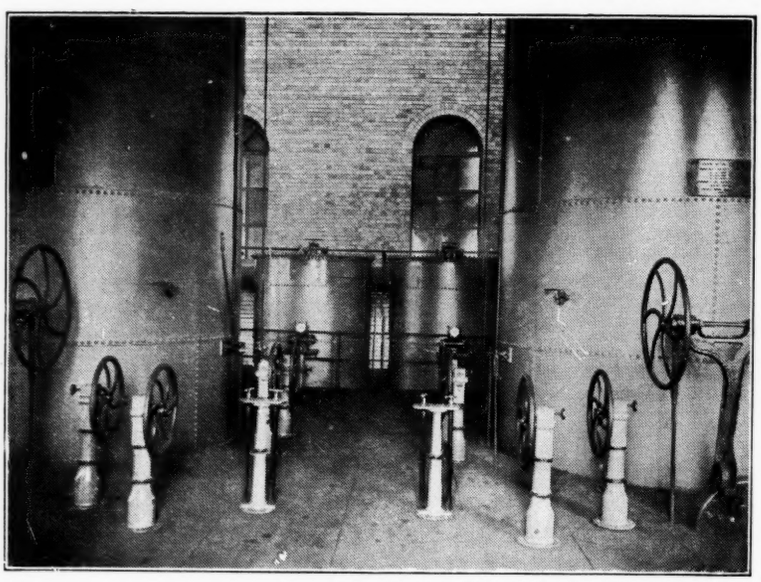

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Consett District Water Supply.—An adjourned conference of representatives of public bodies in North-West Durham and the Chester-le-Street district took place last Wednesday, to consider the question of the local water supply. There has recently been a water famine in the Consett Company's area; and it was proposed at the conference that a Local Government Board inquiry be held with a view to taking steps to prevent similar inconvenience in the future. It was pointed out that the Water Company had, according to their last Act of Parliament, until 1904 to complete their new reservoir, and that under these circumstances an inquiry would be useless. The resolution was, however, carried by five votes to two; and it was subsequently agreed that the Councils should appoint Committees to watch the interests of the public in regard to the Bill to be submitted by the Company to Parliament next session.

Swindon Water Supply.—The Corporation of Swindon are taking steps to obtain a Provisional Order empowering them to borrow additional money to cover the cost of certain works which have for their object the augmentation of the present water supply. For a long time the water obtained from the Wroughton Hills has been insufficient for the needs of the borough; and the Local Authority have been compelled to purchase large quantities yearly from the Great Western Railway Company. Recently experimental works have been carried out at Ogbourne, some eight miles away, with very excellent results. A well has been sunk in the chalk, and a supply of pure water obtained which it is confidently anticipated will be ample for the present and all future needs of the town. This will be conveyed to the reservoir at Overtown, where it will be stored; gravitating thence to the reservoir at Okus, or direct into the mains of the town. Alderman Wright, the Manager of the Locomotive Department of the Great Western Railway Works, has been appointed Chairman of the Water Committee of the Corporation.

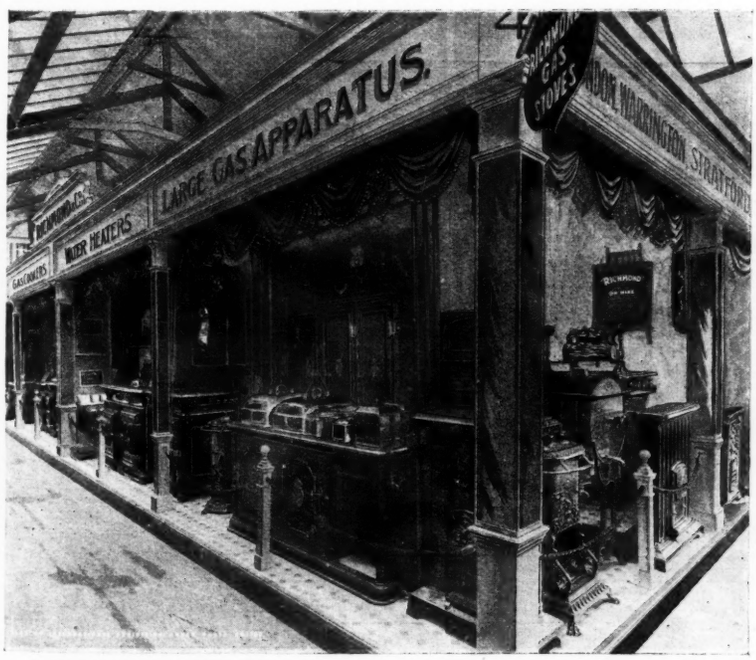
German Incandescent Gas Share Company.—The annual general meeting of this Company was held last Wednesday. Mr. R. T. Bayliss, who presided, said the Company had only one source of income—viz., the shares held in the Deutsche Gasgluhlicht-Actiengesellschaft. The dividend paid by that Company this year being only 28 per cent., against 33 per cent. for the previous year, the distribution now recommended was at a lower rate. The general expenses for the period under review were only £336, compared with £528 the previous year. In addition to the amount received in respect of dividend on the shares of the German Company, they had during the year realized £1984 from the sale of the right they had, as shareholders, to subscribe for 83 new shares in the Company at 3080 marks per share. This sum, however, was not available for dividend purposes; being in a similar position to the £2000 of unexpended capital, so far as distribution was concerned. The present price of the shares in the German Company was 3100 marks, while the sale of the Gas Share Company's right to subscribe was on the basis of a price of 3592 marks. The report was unanimously adopted, and a dividend of 3 per cent. declared on the paid-up capital of the Company.

Haverhill Water Supply.—At the last monthly meeting of the Haverhill Urban District Council, it was stated that the revenue for the year ending March 31 was not sufficient to cover the expenses. Mr. C. French said they were really "giving the water away" at 1s. per 1000 gallons. Practically it cost them 1s. 10½d. per 1000 gallons, including interest on the loan. Revision of the charges was strongly urged by several members; the report being referred back to the Water-Works Committee for consideration.

End of the Milan Strike.—The strike of workmen in the service of the French Company who supply Milan and other places in Italy with gas, to which reference was made in the "JOURNAL" for the 26th ult., was fortunately not of long duration. The Cathedral City—the *fons et origo mali*—appears to have been the greatest sufferer, as a supply of gas was kept up in Genoa and Alessandria. However, Directors and men came to terms, and the latter resumed work—no doubt to the great relief of the inhabitants.

Brynmawr Water Supply.—It was reported to the Brynmawr District Council last Tuesday evening that Messrs. Haller and Machell, engineers, of Dewsbury, estimated that thorough extensions and alterations of the water-works would cost upwards of £14,000. The Council decided to carry out work to the amount of £8000; but the Local Government Board now require something additional to be done, which the engineers estimate will raise the cost of the section to £11,000. The matter was adjourned for report.

Loughborough Gas Supply.—At the meeting of the Loughborough Town Council on Monday last week, the accounts of the Gas Committee for the six months ending the 30th of September were presented, showing a gross profit of £1031. Alderman Bumpus explained that this was the worst half year, as the consumption of gas during the summer was comparatively small. The winter was the time when they made nearly the whole of their profit. In the nine months' statement presented some time back, they showed a profit of £3882; and if, to make a year, they added half of the profit in the present statement, which would be £515, they would get a total of £4397 as being the profit of the first twelve months of the management of the gas undertaking by the Town Council. He thought this was a satisfactory result. That the first nine months turned out so propitiously was in a large measure due to the favourable prices obtained for residuals. There had been an increase of 5 per cent. in the consumption of gas compared with the corresponding half year. This was mainly due to the fact that there had been a large increase in the sale of gas for cooking and in connection with the slot-meter installation—the number of stoves having gone up by 115, and the slot installations at the end of the half year numbering 412, whereas in the corresponding six months there were none. The leakage was 5 per cent. less than in the corresponding six months of the previous year. In reply to a question put to him by one of the members (Mr. Cartwright), Alderman Bumpus said that, in round figures, the repayment of principal and interest amounted to £6000 a year, and, roughly speaking, £1700 had to come from the rates.



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CRYSTAL PALACE,

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There will be several remarkable Novelties.

Hayle Gas Company.—At the annual meeting of the Hayle Gas Company yesterday week, accounts were submitted showing a profit on the year of £531. Mr. Vivian, who presided, spoke of the favourable position of the Company, and stated that during the year a new bed of retorts had been erected on the generator system, the cost of which had been charged to the year's revenue account. An addition was being made to the coal-store. A dividend of 5 per cent. was declared.

Gas-Workers' Wages at Workington.—An application made on behalf of the employees at the Workington Gas-Works by the Gas Workers' Union has been considered by the Gas Committee of the Corporation, who recommend as follows: That stokers be paid time-and-a-half for 24 hours of Sunday; that the application for an increase of 3d. per day, and the reduction in the number of retorts, be not granted; that the application for an eight-hour day for enginemen be not conceded, but that they be relieved of one shift per week; that coal-wheelers be dispensed with, and that labourers be put on when any wheeling is necessary; that the hours of yard labourers remain as at present; that the fitters be granted an increase of 3s. per week, and blacksmiths 2s. a week; and that the extra pay for overtime remain as at present – namely, time-and a-half for 24 hours of Sunday.

Southwark and Vauxhall Water Company.—The report of the Directors of this Company for the half year ending Sept. 30 sets forth that the number of new domestic supplies taken into charge during this period was 844, estimated to produce an increased annual rental of £1932; and in addition the income derived from rates for supplies by meter and other sources shows a satisfactory increase on the corresponding period of past years. Reference is made to the notices for the Bills to be promoted by the Government and the London County Council for dealing with the London Water Supply, and to the satisfactory manner in which the Companies maintained the service through the severe drought of the summer and early autumn. The Directors recommend a half-year's dividend at the rate of 5 per cent. per annum on the preference stock and 7 per cent. per annum on the ordinary stock and class "D" shares.

Water Supply by Meter for Trade Purposes.—The High Wycombe Corporation have lately been considering the question of the supply of water by meter to a firm of ironmongers in the town. A Committee reported that the Water Company had offered to provide a meter at their own expense; and that the Council were recommended to sanction this proposal, provided the meter was of a pattern approved by the Manager of the water-works, and under the control of the authority, and also that the water should be supplied to the firm's premises by meter subject to a minimum charge of £2 2s. per quarter. Some discussion took place on the subject. One member begged the Corporation not to allow any firm to supply their own meter, and argued that if the Corporation supplied the water, they should also supply the meters. It was explained that one of the reasons why the Corporation had set their faces against meters was because they had not the money to purchase them. Eventually the recommendation of the Committee was adopted.

Burgess Hill Water Company.—The revenue of the Company for the six months to Sept. 29, inclusive of a balance of £83 brought forward, was £2222, and the expenditure £1189. Dividends have been declared of 3 per cent. on the original and new ordinary shares, free of income-tax; and it has also been decided to issue 500 new ordinary shares of £10 each.

Grand Junction Water Company.—At the ordinary half-yearly meeting of this Company to-morrow, the Directors will report that, after providing for the Company's proportion of the interest on the Staines Reservoirs Committee's debenture stock and expenses (£5461 6s. 10d.) and for the dividends recommended, the amount of undivided profit carried forward will be £29,793, compared with £25,508 at the commencement of the half year. With regard to the accounts accompanying the report, the payments under the head of "rates and taxes" were £1539 in excess of those for the corresponding half of last year. Certain of them, however, may be reduced on the settlement of the appeals which the Directors found it necessary to enter against the increased assessments, and which have been reported in our columns. The increase in the number of supplies during the half year was 1063; making a total of 68,998. Owing to the deficiency in the rainfall during the past summer, the Company were called upon to supply water under the Intercommunication Act for the assistance of the East London Company. The Directors recommend that a dividend be declared for the last financial half year at the rate of 8 per cent. per annum on the £50 "A" and £25 "B" shares, of 7½ per cent. on the £25 "C" shares, and of 7 per cent. on the £50 "D" shares, and for three months on the new £50 "D" shares sold by auction in June.

Complaints of Impure Gas at Holyhead.—It is stated by the "Liverpool Mercury," that for several days past the impurity of the gas supplied at Holyhead has been the general topic of conversation; and it has been universally condemned. On Sunday week, the gas in the churches had to be extinguished in some instances, and the services curtailed in others; and in the houses it was the same. At the Urban District Council, on Tuesday evening, Councillor Joseph Evans complained of the horrible stuff called gas, and wished to know if some steps could not be adopted to end or mend it. The Rev. John Hughes said that it was simply outrageous for the town to be supplied with an inferior gas. Pending the establishment of electricity works, he would advocate paraffin oil being used. Mr. Hall was of opinion that the Gas Company could be proceeded against for supplying an article that was positively injurious to the health of the community. The Clerk (Mr. J. L. Griffith) observed that many people imagined, because he held shares in the Company, that he favoured it; but he would smash the concern for supplying such wretched stuff. No other town in the United Kingdom would tolerate such a state of affairs for half-an-hour. Mr. C. E. M. Prichard favoured more drastic measures being adopted. The Company had agreed to supply pure gas. Now, however, they furnished impure gas; and the Council would be justified in cutting off the supply at the mains. It was resolved to take Counsel's opinion, and immediately institute legal proceedings against the Company.

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SULPHATE OF AMMONIA PLANTS.

Gas-Meter Indices to be Tested in Manchester.—For some time past, a desire has been manifested in Manchester to have a stricter test applied to gas-meters than has been customary, by including a test which does not come within legal requirements. The Gas Committee of the Corporation have had the subject under consideration, but have hesitated to incur the additional expense of about £450 per annum which the double test would involve. They resolved, however, at their meeting on Friday, at the suggestion made by the City Justices, to adopt it.

Southport Corporation Gas Supply.—The revenue account of the Southport Corporation Gas Committee for the half year ended Sept 30, 1901, shows an expenditure to the amount of £24,354, and an income of £27,586—leaving a gross profit of £3232. On the net revenue account, there is an expenditure of £5609; leaving a deficit of £2377. During the quarter ended the 29th of September, the quantity of gas made was 81,726,000 cubic feet—an increase on the corresponding period of last year of 2,623,000 cubic feet. The net increase of gas sold was 3,205,000 cubic feet.

Profits and Price of Gas at Bolton.—It has been the custom of the Bolton Corporation Gas Department to grant at least £20,000 a year from the profits in relief of the rates. This year, however, it has been found that the profits will not reach the amount estimated; and the Gas Committee therefore proposed to increase the price of gas by 3d. per 1000 cubic feet. In the course of a long discussion on the matter at last Wednesday's meeting of the Town Council, Mr. Tootill pointed out that during his experience of the undertaking the amount allocated in aid of the rates had increased from £5000 to as much as £24,000. There were about 40,000 consumers, of whom 25,000 were cottagers; and he asked why they should tax the working classes and the industries of the town while the residential ratepayers who used electricity were left unburdened. He objected to £20,000 being voted in aid of the rates, when it was known it would be practically impossible to make it. Mr. Horrocks moved an amendment that the increase in the price be 2d.; contending that this would meet the exigencies of the matter. Dr. Panton urged that a sufficient sum was not allocated to depreciation account. He believed the figure should be £15,000 rather than £12,000. Mr. Haslam referred to the fact that the profits of the department had fallen considerably below the estimate, largely on account of the drop in the price of residuals. The amendment was lost by 16 votes to 57; and it was resolved to raise the price of gas from 2s. 8d. to 2s. 11d. per 1000 cubic feet.

The annual dinner of the staff and foremen employed by the firm of Messrs. R. & A. Main, Limited, was held in the Railway Hotel, Falkirk, on the evening of Friday last. Mr. A. P. Main occupied the chair. The toast of the evening, "Messrs. R. & A. Main, Limited," was proposed by Mr. Charles Ferns, traveller, who said that nearly twenty years ago the firm started in a very small way, and as year after year passed it progressed so much that this year they had to put up their camp at Falkirk. At present they had 10 acres of ground; and the works were so constructed that in the event of any extension being required this could easily be carried out without interfering with the existing works. This was a proof of the progress and the enterprise of the firm; and at the same time it also bore testimony to the quality of the goods they had produced. The Chairman, in responding, said that in spite of the keen competition which was going on, he believed the year just ending would be the best, as regards their turnover, they had had.

The position of the Richmond Gas Stove and Meter Company, Limited, to-day is the result of constant application and endeavour to develop business on lines which would be to the mutual advantage of their customers and themselves. What they have done in this respect need not be specially stated here. It is well known, and will also be found set forth in an advertisement supplement to this week's issue. But in the process of expansion, they last week made another move forward by absorbing the old-established business of Messrs. George Newton and Co., of Oldham, known as the Prince of Wales Meter Works. The Company took this step owing to the number of inquiries received for wet meters; so that now, under their scheme for the development of "day consumption," they will be in a position to supply either wet or dry meters. We understand that Mr. Robert Newton will continue his connection with the Company as Consulting Engineer, and that the services of Mr. George Newton are also to be retained. At the same time, they have purchased Messrs. W. & C. Staples' business of some twenty years' standing. This business, together with the machinery, plant, stock, &c., has been transferred to the Company's new premises at Chelsea, immediately adjoining the present works. Here, Mr. Walter Staples will take charge of the automatic attachment department. It is stated that the new Chelsea premises will at once double the Company's manufacturing capacity, and greatly increase the warehouse room. A satisfactory feature in connection with the purchase of these businesses is that both have been made without the issue of fresh capital, which is certainly a good thing from a shareholders' point of view. Originality has been one of the strong points of the Richmond Company. We have before us an example in a poster which has been placed in every workshop and department of the Company's premises. It relates to a new scheme of prizes for employees' suggestions, ideas, or inventions. Prizes are to be awarded every three months, and will be considered at the works by the respective Profit-Sharing Committees, half of whom are nominated by the workmen, and half by the Directors. As an illustration of the awards made last month by the Company to the employees, we may give the following: A clerk while on a holiday found that the seaside company where he stayed were commencing slot installations. He advised works, and an order was secured. Another clerk, also on holiday, noticed a quantity of stoves packed in a new manner. He took particulars, and reported it. This is likely to effect a considerable saving. A tinman in the employ of George Glover and Co., Limited, suggested improvements in Richmond's tinmans' stove that he was using. Another tinman produced an improved cash-box for coin meters. Recognition of this kind is bound to act as a spur to individual effort.

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WITH THE
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IS THE
CHEAPEST
System of
CHARGING
AND
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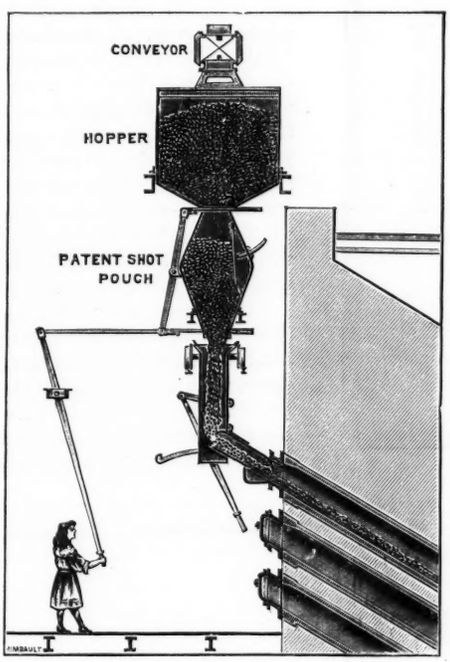

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HOT-COKE CARRIER
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We guarantee its life.

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NEW CONVEYOR CO., LD., SMETHWICK.

Messrs. Kirkham, Hulett, and Chandler, Limited, have received an order from the Great Yarmouth Gas Company for a patent "Standard" washer-scrubber for one million cubic feet of gas per day.

At their meeting on Monday last week, the Uckfield Rural District Council approved of the proposal of the Uckfield Water Company to apply to the Board of Trade for a Provisional Order to raise additional capital and extend their limits of supply.

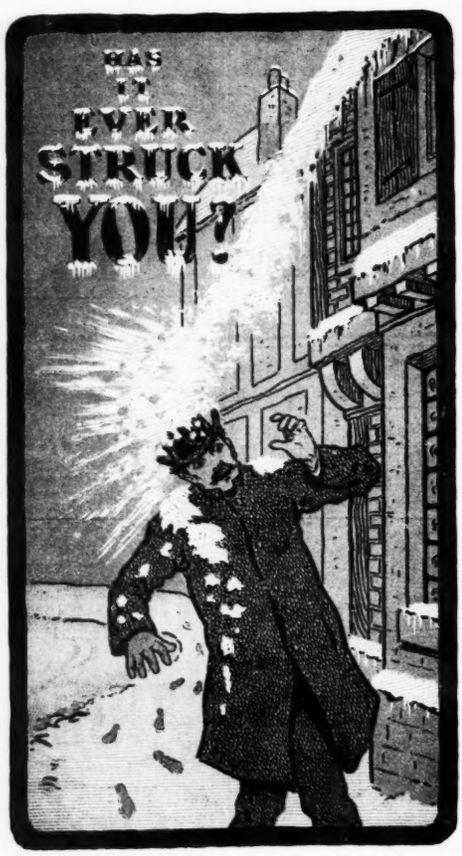
The Manchester Gas Committee have accepted tenders for the supply of oil for carburetted water gas manufacture; a contract for 12,000 tons being given to the Anglo-American Oil Company, and one for 6000 tons to the Roumanian Oil Trust. The contracts for the supply of the ensuing season's requirements in fire-clay goods have been distributed among Messrs. Harris and Pearson, B. Gibbons, jun., and H. T. Hickman; and Silica goods for all the works are to be supplied by the Silica Fire-Brick Company.

On Monday of last week, the Chairman and Vice-Chairman of the Gas and Electricity Committee of the Stafford Corporation invited the members of the Council to inspect the carburetted water-gas plant which has recently been installed. The new works were visited, and the manufacture of water gas explained by Mr. Hubert Pooley, the Gas Manager, after which the Mayor turned on the valve, and the manufacture of the gas was demonstrated. The Company then paid visits to the sulphate works in course of erection, and also to the electric lighting works.

We learn that copies of the photograph of the members of the Manchester and District Institution of Gas Engineers, taken at Wakefield last Saturday week, can be obtained from Messrs. G. & J. Hall, Cathedral Studio, of 9, Westgate, Wakefield. The price is 3s. 6d. each., post free.

Our contemporary the "Ironmonger" this week expresses the belief that, in a place habitually visited by fog, incandescent gas would be the only feasible means of illumination. It is suggested that, where arc lighting is used, it would be a good plan to fix gas-lights on the same posts, but at a lower level than the arc lamps, and use both in bad weather.

The officials of the Manchester Corporation Gas Department had their annual gathering last Friday night at the Hulme Town Hall; and about 250 were present. It was the 29th annual reunion; but it had an additional interest this year, it being the golden wedding year of the Superintendent, Mr. Charles Nickson, who, with Mrs. Nickson, was recently the recipient of a presentation from the staff to mark the event. The arrangements were excellently carried out by the Committee. The proceedings, over which Mr. Nickson presided, began with a tea, followed by an interesting concert, the performers at which were, for the most part, members of the department; and concluded with a dance. The programme bore on its back, as a *souvenir*, portraits of Mr. and Mrs. Nickson. During the evening, Alderman R. Gibson, Chairman of the Gas Committee, was present as a guest.



HAS IT EVER STRUCK YOU

What a close relation there is between **Temper and Temperature?** Perhaps you have come downstairs on a snowy winter morning to find the breakfast room as smoky as a volcano, but by no means as warm, and Mary Ann—in tears and smudges—trying, on her knees, to wheedle the cold-hearted fire into kindling, while your eyes watered with the smoke, your teeth chattered with the cold, and the only hot thing in the room was your temper!

People sometimes talk of "nursing" a fire. That seldom refers to a gas-fire, and never to one of Wright's. In time of sickness, when an even heat has to be kept up overnight, the only plan is to sit up with your coal fire during the small hours, and administer its regular doses of fuel, as if the fire were an invalid, the scuttle a doctor's bottle, and every shovelful of coals a spoonful of the "Mixture." No wonder the disgusted subjects of **Old King "Coal"** begin to plot treason against him! If you feel that way, you need not hesitate to dethrone the grimy monarch, for his **Legitimate Successor** is close at hand. If you "can never get that fire to *go*," then it is time it *went*, and gave place to a Wright's "Eureka" Gas-Fire, which is as good as a coal fire in warmth and cheeriness, and far better in everything else. With Wright's Gas-Fires, you can have the heat as **soon** as you like, as **strong** as you like, and as **long** as you like. There are no delays, no smoke, no soot, no ashes, no coal dust, no—we had almost run on and said "no Mary Ann"! *That* would perhaps have been the best riddance of all; and indeed the lady who has Wright's "Eureka" Gas-Fires in her rooms (and a "Eureka" Gas-Cooker in her kitchen) has no need to quail at the domestic tyrant's awful announcement—"Which I wishes ter give yer notice, mum." Her mind may be quite at ease; for in the interval between the exit of Mary Ann and the advent of Eliza Jane, the **Eating and Heating** departments, at least, will give no trouble. Whatever statesmen may do, it is high time for you to abandon your **Policy of "Scuttle,"** and begin a new era of domestic comfort with Wright's "Eureka" Gas-Fires—the best to look at, and the best to sit at, of any kind of fire in the market.

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Experience with High-Pressure Incandescent Gas Lighting will be considered an advantage. He must also be competent to superintend and maintain Internal Fittings of every description; assist in the Show-Room if required; and take charge of, and be responsible for, the whole of the Outdoor Staff, including Workmen.

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The means of such transport must be purchased by the person appointed; but towards this outlay an advance on loan will, if necessary, be made by the Commissioners.

Quarters are not provided.

Salary and Allowance will be paid monthly in the local dollar currency of the Straits Settlements. The dollar is at present worth one shilling and elevenpence (1s. 11d.), and has varied in value during the last twelve months from 1s. 11d. to 2s. 2d.

Free passage to Singapore will be provided. First-class by Japanese Mail or other outside line, or second-class by English Mail. Similar return passage will be given upon satisfactory termination of agreement. Half Salary will be paid on the voyage out.

The selected Candidate must pass a satisfactory medical examination.

Applications, stating Age, place of Birth, and giving details of Education, Training, and Experience, accompanied by *copies only* of not more than Six recent Testimonials, will be received by C. C. LINDSAY, Esq., M.Inst.C.E., 217, West George Street, Glasgow (who will give further Information if requested) not later than Thursday, the 12th of December next.

NOTICE OF REMOVAL.

BALE & CO. have removed to larger and more convenient Premises,
No. 122, NEWGATE STREET, LONDON, E.C.
BALE'S OXIDE OF IRON, FIRE CEMENT, &c.
Telegrams: "BOGORE, LONDON."
Telephone "277 HOLBORN."

WANTED, for a small Gas-Works in the Midlands, a WORKING MANAGER. Wages £1 per week, with House and Garden, Coal and Gas.

Apply to Mr. W. T. TEW, Gas-Works, WARWICK.

THIRTY Tinmen Wanted immediately (Case Makers and Finishers).

Apply to the METROPOLITAN GAS-METERS, LTD., Works, Willowbrook Road, Trafalgar Road, OLD KENT ROAD, S.E.

WANTED, a Foreman Retort Setter, used to Inclines. Permanency for a suitable Man,

Apply, stating Age, Experience, References, and Wages required, to the ENGINEER, Gas-Works, Saltley, BIRMINGHAM.

WANTED, a Man to set Retorts and do general Bricklaying at Works near Birmingham. Must be used to Regenerative Settings. Permanent Situation to suitable Man.

State Age, Experience, Wages required, &c., to No. 3753, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

OWING to the present Manager of the Ballymena and Harryville Gaslight Company, Limited, having been appointed to larger Works, the Company require a MANAGER.

Applications, accompanied by Testimonials and stating Salary expected, to be sent to Mr. SAMUEL HOOD, Chairman, Ballymena and Harryville Gaslight Company, Limited, Mill Street, BALLYMENA.

CITY OF BIRMINGHAM.
(GAS DEPARTMENT.)

THERE is a Vacancy at one of their largest Gas-Works for a RESIDENT SUPERINTENDENT. Preference given to one experienced in the working of Inclined Retorts and Regenerative Furnaces.

Commencing Salary, £400 per annum.

Applicants must not be under 30 years of Age, and should apply, by letter only, stating qualifications and enclosing references, to the ENGINEER, City Gas-Works, Saltley, BIRMINGHAM.

WANTED, immediately, by a Corpora- tion in Kent, a thoroughly Practical WORKING MANAGER for their Gas-Works. The annual make at present is about 13 million cubic feet per annum. The man selected must be competent to undertake the entire management of the Works, and the distribution of the Gas. He must be able to do Main and Service laying, Cooker and Gas-Fire fixing, Prepayment and Ordinary Meter fixing, and read Indices, and must be able to keep the usual Books relating to the Manufacture and Distribution. One Fitter will be allowed him during the heavy months of the Year.

None but steady and practical men need apply.

Salary £3 per week.

Applications, in handwriting of Candidate, stating Age, whether Married or Single, and giving not more than three References, to be sent to No. 3787, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C., on or before the 13th inst.

SOWERBY BRIDGE URBAN DISTRICT COUNCIL.

GAS ENGINEER AND MANAGER.

THE post of Gas Engineer and Manager to this Council will be vacant, owing to the resignation of the present Manager and Engineer, in March next. The Council invite applications for the vacant post.

The average make is about 120 million cubic feet.

Applications, endorsed "Gas Manager," should be sent so as to reach me not later than Saturday, the 28th of December inst.

Applicants are requested to state Age, Previous Experience, Salary Required, and to furnish *copies* of recent testimonials only.

Dated this 6th day of December, 1901.

R. W. EVANS,
Solicitor and Clerk to the Council.
Commercial Bank Chambers,
Halifax.

TO BE LET on Lease—The Charlbury GAS-WORKS, with Manager's Cottage and Coal-Wharf. Possession the 1st of April, 1902.

Sealed Tenders to be sent to the Honorary Secretary, G. MORRIS, CHARLBURY, on or before the 31st day of December next.

WANTED, a Set (three or four) of good second-hand PURIFIERS complete; also TOWER SCRUBBER suitable for small Works of about Ten Millions per annum.
Particulars to the MANAGER, Gas-Works, WIDNES.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

TO BE SOLD—
GASHOLDER (and Cast-Iron Tank), 17,500 cubic feet capacity.
CENTRE-VALVE, 15 in. diameter, by Walker for Four Purifiers.
Four PURIFIERS, 10 feet square, in line, with Planed Joints, Walker Centre-Valve, Covers, and Traversing Crab Lifting Gear. Will be refixed equal to new.
Write J. WRIGHT, Bridge House, BLACKFRIARS, E.C.

J. FIRTH BLAKELEY & CO., Thornhill, Dewsbury, have FOR SALE cheap—
ANNULAR CONDENSERS up to 16-in. Connections.
EXHAUSTERS and ENGINES up to 60,000 feet per hour.
"HOLMES" and "CLAPHAM" WASHERS and TOWER-SCRUBBERS.
GASHOLDERS, 15 ft., 25 ft., 30 ft., and 50 ft. diam.
PURIFIERS, sets of 6 ft., 8 ft., 10 ft., 12 ft., and 20 ft. square.
J. F. B. & Co., are the largest Buyers and Dealers in SECOND-HAND GAS PLANT, and have an extensive Stock. Inquiries solicited from both Vendors and Purchasers of the same.

THE Solihull Gas Company have for DISPOSAL four ⌂ MOUTHPIECES (Tangyes patent) 18 in. by 14 in., 5-inch outlet; six Oval MOUTHPIECES (Tangyes patent), 24 in. by 15 in., 5-inch outlet; seven 5-inch ASCENSION-PIPES; four 5-inch elbow ASCENSION-PIPES; ten 5-inch H-PIPES with Dip-Pipes cast on; also 6-inch CENTRE-VALVE for four Purifiers.
Any further Information may be obtained from Mr. T. Jowett, the Company's Manager.
Offers to be sent to the Secretary, Bank Buildings, Solihull.
F. L. THOMPSON,
Secretary.

CITY OF LOUVAIN.

LIGHTING CONTRACT.

THE Contract for the Lighting of Louvain by Gas will Expire on Jan. 1, 1905. The Municipality are therefore prepared to receive, before Dec. 31, 1901, PROPOSALS for Lighting the City, either by Gas or Electricity, or by the Two Systems combined, from Gas or Electric Light Companies.
Address the BURGOMASTER, LOUVAIN, BELGIUM.

BOROUGH OF ROCHDALE.

TO RETORT MAKERS AND OTHERS.

THE Gas Committee of the above Cor- poration invite TENDERS for the supply of such quantities of RETORTS, FIRE-BRICKS, and other FIRE-CLAY GOODS as they may require during the ensuing Twelve Months.
Forms of Tender may be obtained on application to Mr. T. Banbury Ball, the Manager, at the Gas-Works, Dane Street, and must be sent in to the undersigned not later than noon on Wednesday, Dec 18, 1901.
By order,
JAMES LEACH,
Town Clerk.
Town Hall, Rochdale,
Nov. 30, 1901.

BOROUGH OF CHORLEY.
(GAS DEPARTMENT.)

FIRE-CLAY GOODS.

TENDERS are invited for the supply and delivery of RETORTS and FIRE-BRICKS.
Form of Tender and further Information as to quantities may be obtained from Mr. J. W. Allin, Gas Engineer.
Tenders, endorsed "Tender for Retorts, &c.," to be delivered not later than Tuesday, the 17th of December, 1901, addressed to the undersigned.
The Committee do not bind themselves to accept any Tender.
By order,
JAS. MILLS,
Town Clerk.

SOUTHWARK AND VAUXHALL WATER COMPANY.

TO COAL MERCHANTS.

THE Directors invite Tenders for the supply at their several Stations of about 30,000 Tons (more or less) of COAL during the Year 1902.
Specification and Form of Tender may be obtained at the Office of the Engineer, upon payment of 10s 6d., which will be refunded on receipt of a *bonâ-fide* Tender.
Tenders, addressed to the Chairman and Directors, Southwark and Vauxhall Water Company, Southwark Bridge Road, London, S.E., must be sent in on or before Monday, the 16th of December next, endorsed "Tender for Coal."
The Directors do not bind themselves to accept the lowest or any Tender.

WILMSLOW AND ALDERLEY EDGE GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the surplus TAR and the whole of the AMMONIACAL LIQUOR produced at their Works from the 1st of January, 1902, to the 31st of December, 1902.
Tenders to be addressed to the undersigned, and delivered not later than the 14th inst.
The Directors do not bind themselves to accept the highest or any Tender.
WM. SEVERS,
Engineer and Manager.
Wilmslow, Manchester,
Dec. 5, 1901.

CLACTON URBAN DISTRICT COUNCIL.

THE above Council are prepared to receive TENDERS for the manufacture and delivery of about 50 Tons of CAST-IRON PIPES and CONNECTIONS.
Copy of the Specification and Form of Tender may be obtained from the Council's Engineer, Mr. Sidney Francis, Town Hall, Clacton-on-Sea.
Sealed Tenders, endorsed "Tender for Pipes," to be delivered to the undersigned not later than Twelve o'clock noon, on Monday, the 16th of December, 1901.
The Council do not bind themselves to accept the lowest or any Tender.
GEO. T. LEWIS,
Clerk to the Council.
Town Hall Buildings,
Clacton-on-Sea, Dec. 3, 1901.

CITY OF LEEDS.
(GAS DEPARTMENT.)

THE Gas Committee of the Leeds City Council are prepared to receive TENDERS for the supply of FIRE-CLAY RETORTS, FIRE-BRICKS, FIRE-BRICK LUMPS, and FIRE-CLAY.
Specification and form of Tender may be obtained on application to the undersigned.
Tenders, endorsed "Fire Goods," and addressed to the Chairman of the Gas Committee, Municipal Buildings, Leeds, will be received not later than Thursday, the 19th inst.
The Committee do not bind themselves to accept the lowest or any Tender.
R. H. TOWNSLEY,
General Manager.
Gas Offices, Leeds,
Dec. 6, 1901.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS from Iron Founders, Gun-Barrel Manufacturers, Timber Merchants, Druggists, Ropemakers, &c., for GOODS to be delivered on the Company's Works, Great Brunswick Street, in such quantities as may be required from time to time up to the 31st of December, 1902.
Samples of goods required are open to inspection on the Works, Great Brunswick Street; and printed lists of articles required can be had on application at the Company's Offices, D'Olier Street.
Tenders, endorsed "Tenders for Stores," to be lodged in my Office, on or before the 27th inst.
FRANCIS T. COTTON,
Secretary.
D'Olier Street, Dublin,
Dec. 7, 1901.

MANCHESTER CORPORATION.
(GAS DEPARTMENT.)

STEEL ROOF.

THE Gas Committee are prepared to receive TENDERS for the supply, delivery, and erection of a STEEL ROOF, with Columns and Girders for supporting same, at their Rochdale Road Station.
Drawings may be seen on application to Mr. J. G. Newbigging, C.E., at his Office, Rochdale Road Station.
General Conditions of Contract, Specification, and Bill of Quantities can be obtained on application (in writing only) to Mr. C. Nickson, Superintendent of the Gas Department, Town Hall, on payment of One Guinea, which will be returned on receipt of a *bonâ-fide* Tender.
The Committee do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Steel Roof," must be delivered at the Gas Office, Town Hall, on or before Thursday, the 19th inst.
By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.
Town Hall, Manchester,
Dec. 6, 1901.

BOROUGH OF SMETHWICK GAS-WORKS.

GAS ENRICHING.

THE Gas Committee are prepared to receive TENDERS for the supply of BENZOL, and also of OIL suitable for the Manufacture of Carburetted Water Gas.
Analysis and full description, with a sealed sample of the Oil offered, must be sent with the Tender.
The Oil and Benzol must be delivered free at the Gas-Works, Rabone Lane, Smethwick, in such quantities and at such times as may be required by the Committee during the six months ending June 30 next.
Sealed Tenders, endorsed "Oil or Benzol," as the case may be, to be addressed to the Chairman of the Gas Committee, and delivered to the undersigned not later than the 19th inst.
The Committee do not bind themselves to accept the lowest or any Tender.
By order,
W. J. STURGES,
Secretary.
Gas Offices, Town Hall,
Smethwick, Dec. 7, 1901.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS, in respect both to the FOUR-AND-A-HALF PER CENT. and THREE PER CENT. DEBENTURE STOCKS, WILL BE CLOSED from the 12th to the 31st of December inst., both days inclusive, and RE-OPENED on the 1st of January, 1902, on which date the Interest Warrants on these Stocks will be payable.
By order,
I. A. CROOKENDEN,
Secretary.
St. Helen's Place, Bishopsgate Street, E.C.,
Dec. 4, 1901.

SLOUGH GAS AND COKE COMPANY.
INCORPORATED 1866.

SHARE CAPITAL AUTHORIZED		£50,000.
Do.	do.	PAID UP £25,000.
LOAN CAPITAL	PAID UP	£6,000.

ISSUE OF NEW ORDINARY SHARES, AND MORTGAGE DEBENTURES.

THE Dividend on the New Share Capital is limited to 7 per cent. per annum, but is subject to the Sliding-Scale which provides for the Dividend rising 3s. 6d. per cent. for every penny reduction in the price of Gas below the Standard Price of 4s. 5d. per thousand cubic feet, and falling 3s. 6d. per cent. for every one penny increase in the price of Gas beyond the said Standard Price.
The Debentures will be issued for a term of 7 years at 4 per cent. per annum; Interest being payable Half Yearly on 29th September and 25th March.
The Company was incorporated by Act of Parliament in 1866, and its district and powers were subsequently extended by Confirmation Acts in 1884, 1898, and 1901.
The new Capital is required for the erection of New Works and Plant upon the Company's New Site of 5 acres of Freehold Land at Upton Lea, to meet the continued increase in the demand for Gas for several years past. The site has a siding connection with the Great Western Railway, and also adjoins the Grand Junction Canal.
The Company has already erected a Gasholder on this site at a cost of nearly £5000, and it is now proposed to erect New Works and Plant at a further cost of £16,000.
The new Works will be constructed on the most modern principles, and will effect a great saving in the cost of manufacture. The railway siding will also be the means of a considerable saving in cartage.
The progress of the Company during the past Seven years is as follows:—

	Gas Sold.		Total Receipts.
1894.	19,336,000 cubic feet	.. ..	£5115
1895.	21,479,000 ,,	.. ..	£5733
1896.	22,068,000 ,,	.. ..	£5859
1897.	23,945,000 ,,	.. ..	£6331
1898.	26,133,000 ,,	.. ..	£6902
1899.	27,384,000 ,,	.. ..	£7377
1900.	30,852,000 ,,	.. ..	£8324

The District of the Slough Urban Council has lately been enlarged, the town and neighbourhood is improving, and the Company's mains have been, and are still being, greatly extended.
The Dividend paid on New Ordinary Shares was £7 per cent. for over 20 years to June, 1899, and since then the Dividend paid has been £7 7s. per cent., the additional Dividend being paid according to the Sliding-Scale.
At the Auction Sale on the 8th October, 1901, of the same class of Shares as is now offered, the prices realized were £15 to £15 10s. per Share.
The Shares are offered under the conditions of the Slough Gas Order, 1901, which obliges the Company to sell all future Share Capital by Public Auction or Tender.

SLOUGH GAS AND COKE COMPANY.

TERMS OF ISSUE BY TENDER OF 600 ORDINARY SHARES OF £10 EACH, AND OF 30 MORTGAGE DEBENTURES OF £50 EACH.

THE Directors give Notice that they are prepared to receive TENDERS for £3000 in ORDINARY SHARES of £10 each nominal value. Also for £1500 MORTGAGE DEBENTURES of £50 each nominal value.
Holders of Shares will be entitled to Dividend as from 28th February, 1902, and the Dividends will be payable Half Yearly, on the 1st November and the 1st May.
Holders of Debentures will be entitled to Interest at 4 per cent. per annum as from 25th March, 1902, which will be payable Half Yearly, on the 29th September and the 25th March.
Tenders must be delivered at the Secretary's Office 119, High Street, Slough,
BEFORE THE 31ST DECEMBER, 1901,
accompanied by a deposit of £1 per share on the number tendered for, and the balance must be paid on or before the 28th February, 1902.
Tenders for Debentures must be delivered at the same time and place, accompanied by a deposit of £5 per Debenture, and the balance paid on or before 25th March, 1902.
Allotment letters will be issued in the course of a few days after the last day for receiving Tenders.
Where no allotment is made, the Deposit will be returned in full, and in case of partial Allotment, the balance of the Deposit will be applied towards the payment of the Shares or Debentures allotted.
In case of default made in the payment of the balance at the proper date, the deposit previously paid will be liable to be forfeited.
Share Certificates and Mortgage Debentures will be issued in due course, free of expense, in exchange for Banker's Receipt.
Application must be made upon the printed form of Tender, to be obtained at the London and County Bank, Slough, of Mr. R. H. Barrett, Solicitor, Slough and Eton, and of the Secretary.
By order of the Directors,
ARTHUR THOMAS,
Secretary.
Slough, Bucks,
Dec. 5, 1901.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCK, WILL BE CLOSED at Ten o'clock forenoon on Friday, Dec. 13 inst., for the Half Year ending the 31st of December, 1901, and will be RE-OPENED on Friday, the 20th inst.

The Interest for the Half Year will be payable on the 1st day of January next, to the Proprietors registered on the closing of the Books.

By order of the Board,
JAMES RANDALL,
Secretary.

Chief Offices: 639, High Road,
Tottenham, Dec. 6, 1901.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

Now Ready, Price 15s., Limp Cloth,

— TWENTY-FIRST YEAR —

AN

ANALYSIS OF THE ACCOUNTS

OF THE

METROPOLITAN WATER COMPANIES

(Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex)

AND OF THE

CORPORATION WATER UNDERTAKINGS

OF

EDINBURGH, GLASGOW, & MANCHESTER,

FOR THE YEAR 1900-1901.

Compiled by

LASS, WOOD, & DREW,

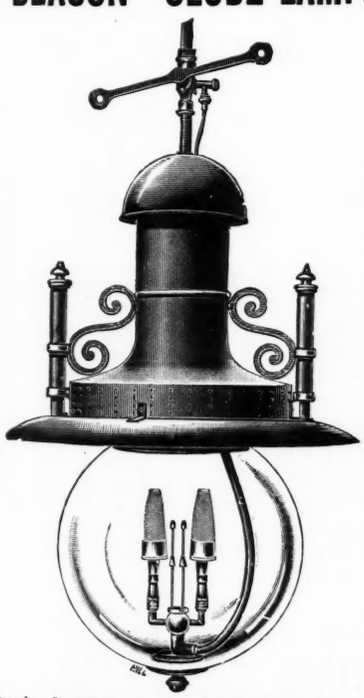
Chartered Accountants.

LONDON:

WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

THE PATENT

"BEACON" GLOBE LAMP.



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A DESCRIPTION

OF THE

ZURICH NEW GAS-WORKS.

By A. WEISS, Engineer of the Works.

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CANNEL COAL MERCHANT,

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Prices and Analysis of all the Scotch Cannels on Application.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas.

Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., Ld.,

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HOT WATER INSTANTLY NIGHT OR DAY.

Hot Bath for 3d. in Five Minutes.

Boiling Water in a Single Minute.

EWART'S LIGHTNING GEYSER

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MADE from Spent Oxide (free from Arsenic) and of excellent Purity. Specially prepared for Sulphate of Ammonia Manufacturers.

Works: BLACKBURN; Miles Platting and Clayton, MANCHESTER.

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RECOVERY OF SULPHUR,

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SULPHURETTED HYDROGEN

in catch position.

Full Particulars on application to the Patentees:

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— LIMITED, —

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GAS LIGHTING,

Describing the Manufacture of Gas and

Its Application to the Purposes of Illumination.

By CHARLES HUNT,

Manager of the Birmingham Corporation Gas-Works.

London: J. & A. CHURCHILL, 7, Gt. Marlborough St.

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Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

JOHN HALL & CO.,

STOURBRIDGE,

Manufacturers of

FIRE-BRICKS, LUMPS, TILES,

GAS RETORTS.

And every description of Fire-Clay Goods.

RETORTS CAREFULLY PACKED FOR SHIPMENT.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

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CRESSWELLS' ASBESTOS CO., LTD.

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Asbestos Spinners and Manufacturers.

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If you want a first-class **NON-CONDUCTING COVERING** for **STEAM BOILERS, PIPES, CYLINDERS, CISTERNS,** or other heated surfaces, drop a line to us. Plastic and Removable Sorts. Ask for No. 4 Catalogue.

Applications for Colonial and Foreign Agencies desired.

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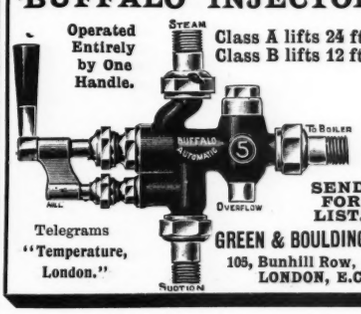

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Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE, SON, & HUNTER,
COAL OWNERS, NEWCASTLE-ON-TYNE
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

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Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
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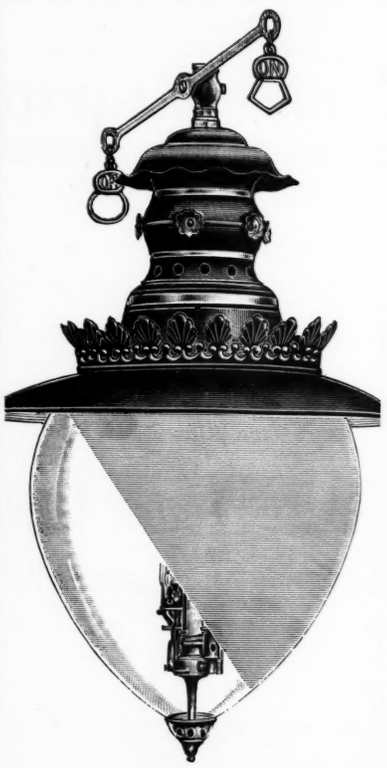
TO SUIT

KERN BURNERS.



J. & W. B. SMITH,

21 & 23, FARRINGDON ROAD,
LONDON, E.C.

WEST'S GAS IMPROVEMENT COMPANY, LTD.

ALBION IRON-WORKS, MILES PLATTING, MANCHESTER;
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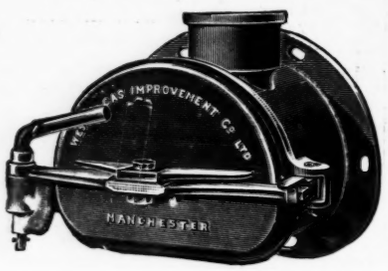

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WEST'S PATENT REGENERATOR SETTINGS.

WEST'S PATENT SILENT COKE CONVEYOR.

RETORT MOUTHPIECES WITH SELF-SEALING LIDS.

METROPOLITAN GAS METERS, Ltd.,

Manufacturers of Dry Gas Meters

(PREPAYMENT & ORDINARY.)

Distinctive Title

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Telegraphic Address:

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GEO. BOULTON & SON, Wholesale Glove Manufacturers, **75, Goswell Rd., London, E.C.**

Will be pleased to send Sample Patterns and Prices to the Managers and Engineers of Gas Companies, similar to those which have been supplied by them to the South Metropolitan Gas Co., The Gaslight and Coke Co., Commercial Gas Co., and others, for 30 years past.

ALL KINDS OF STOUT LEATHER GLOVES FOR FURNACE OR SMELTING WORKS MADE TO ORDER.

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GAS ILLUMINATION DEVICES IN NEW AND ARTISTIC VARIETY.

Write for Catalogue now in preparation.

ORDER EARLY.

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THE POSITIVE METER

Combines the Advantages of both the Wet and the Dry Meters without any of the deficiencies of either.

GREENALL'S POSITIVE METER SYNDICATE, LIMITED,

WORKS: 63, KIRKSTALL ROAD, LEEDS.

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CORRESPONDENCE INVITED.

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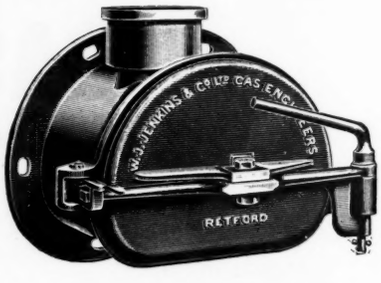

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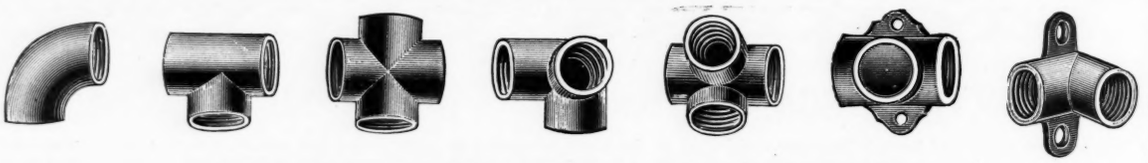
W. J. JENKINS & CO., LTD., RETFORD.



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FOR GAS, STEAM, AND WATER.

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VERITAS LAMP WORKS,

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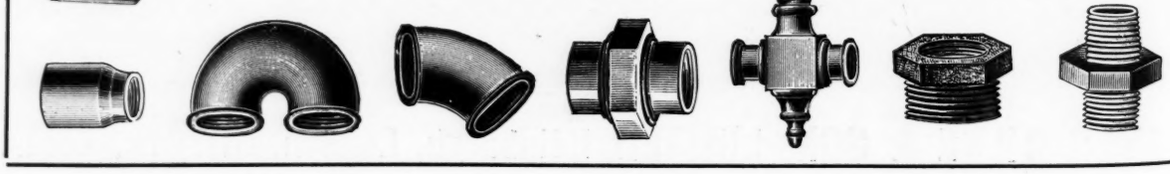

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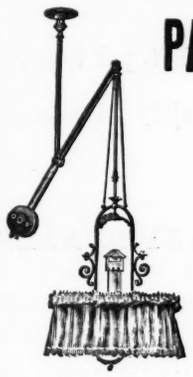

PATENT "SURPRISE" PENDANT,

WITH PATENT SHADE.

The ONLY GAS-PENDANT suitable for Domestic Lighting; a room 18 ft. by 14 ft. being beautifully illuminated with one Incandescent Burner.

Extract from the JOURNAL OF GAS LIGHTING, Jan. 8, 1895.

"IN CONJUNCTION WITH
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it quite **supersedes** the familiar three-light pendant. We are able to bear witness to the **convenience** of the New Pendant."

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UPPER GROUND STREET, LONDON, S.E.,

SUPPLY FROM STOCK

CAST-IRON RETORTS
AND ALL KINDS OF GAS-WORKS APPARATUS
SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of LYON'S "PATENT" GAS-MAIN SYPHONS.
AGENTS FOR
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ARROL-FOULIS
Patent Automatic Machinery
FOR
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GAS ENGINEERS & CONTRACTORS.—CARBONIZING SPECIALISTS.
RETORT SETTINGS & IRONWORK OF EVERY DESCRIPTION.
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ARE UNEQUALLED FOR PRODUCTIVE CAPACITY AND ECONOMY IN FUEL.
Results Guaranteed. Numerous Testimonials.
LARGE AND COMPETENT STAFF OF RETORT SETTERS EMPLOYED.
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MOBBERLEY & PERRY
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Manufacture & supply best quality of
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Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.
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Half Actual Size.

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More Candle Power than any H.P. Burner using 10 ft. per hour.

CAN BE INSTANTLY ADJUSTED to suit the quality of Gas in any District.

The Mantle is Removable. This Burner has been SPECIALLY MADE for High-Pressure Work.

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THE ONLY CONVEYOR WEIGHING-MACHINE IN THE MARKET.

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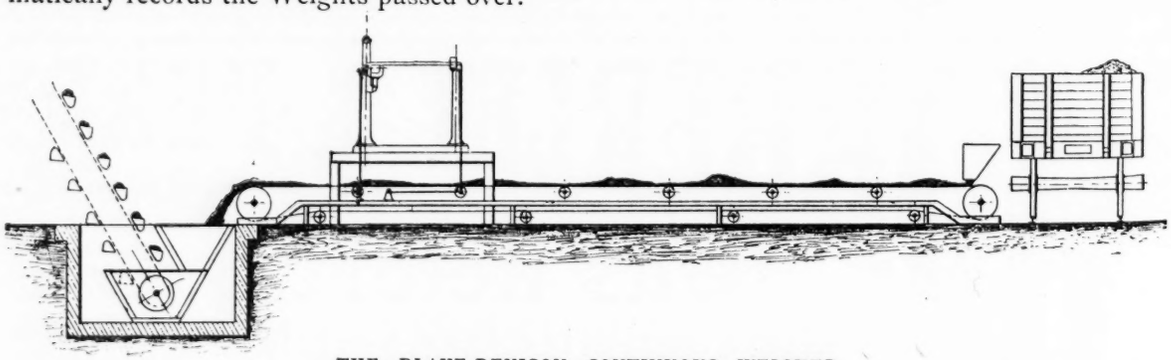

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For Increasing the Capacity of Coal-Gas Works, also for Incandescent Lighting, Driving of Gas-Engines, and Manufacturing Purposes.

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Plants contracted for within the last Eighteen Months for the following Gas-Works: WEST BROMWICH, KÖNIGSBERG, ISERLOHN, LYONS, ERFURT, REMSCHEID, PFORTSHEIM, PLAUEN, BARMEN-RITTERSHAUSEN, NUREMBERG, BRUMMEN,* OSTERFELD,* WARSTEIN,* WIBORG.*

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ALSO TWENTY-SEVEN INSTALLATIONS FOR MANUFACTURING PURPOSES.

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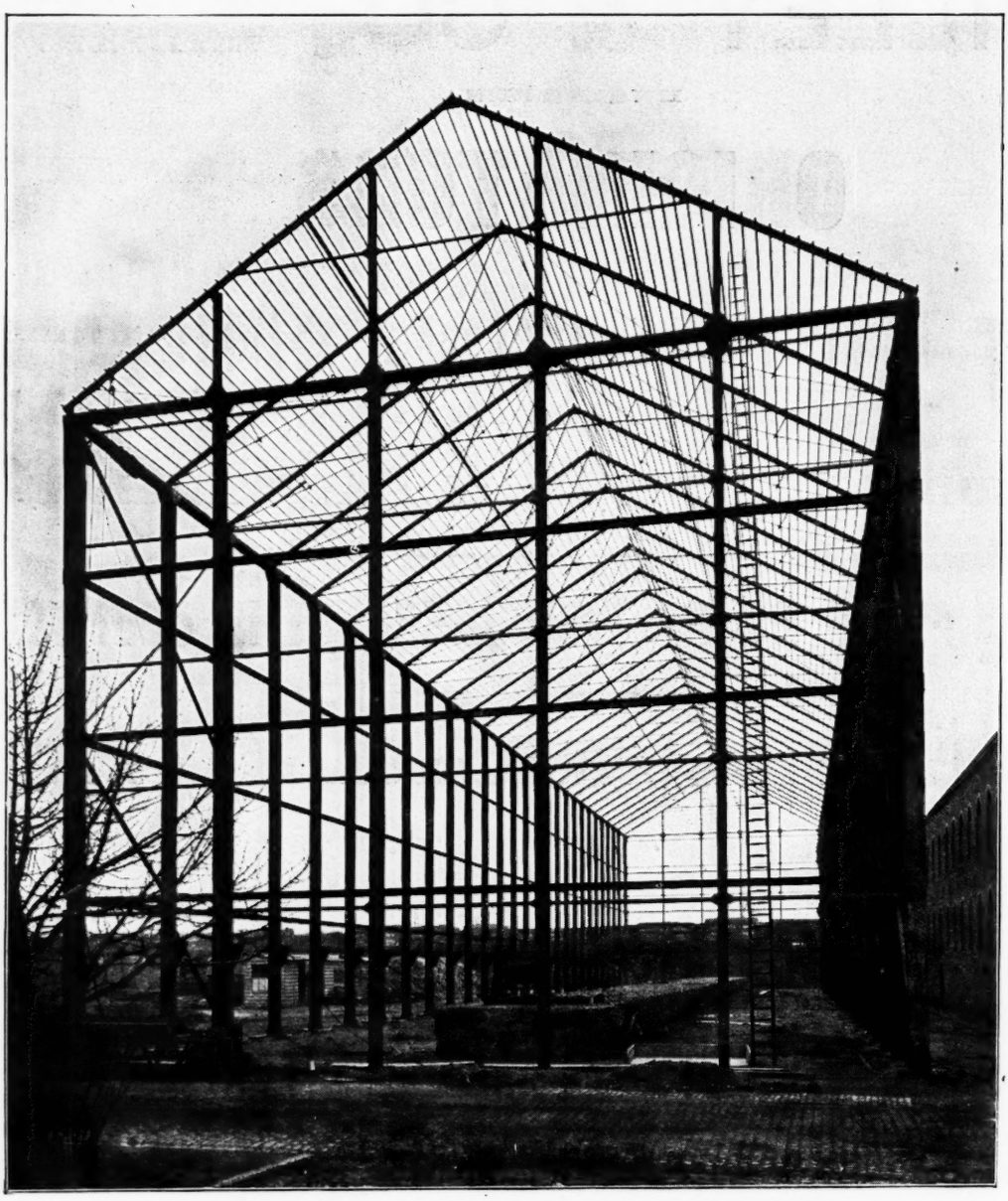
S. CUTLER & SONS, MILLWALL, LONDON.



EVERY KIND OF PLANT FOR GAS AND WATER WORKS. ROOFS. GIRDERS. TANKS. STEEL-FRAMED BUILDINGS.

STEEL RETORT-HOUSE RECENTLY ERECTED BY MESSRS. CUTLER.

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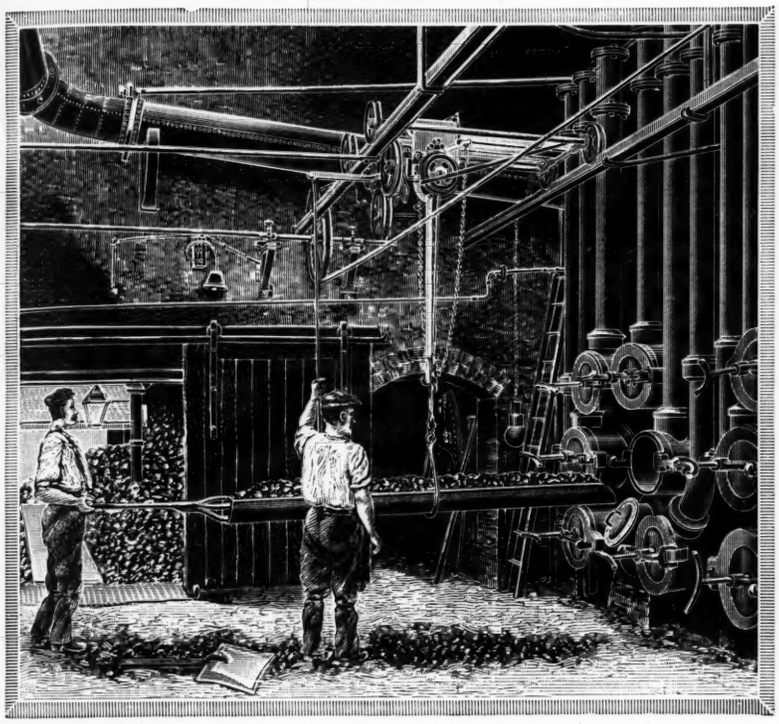
Horizontal Retort Charging Revolutionized



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POWER CHARGING APPARATUS

FOR GAS-WORKS.

Can be seen at work by appointment.

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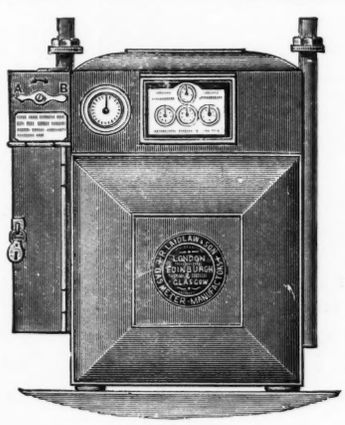
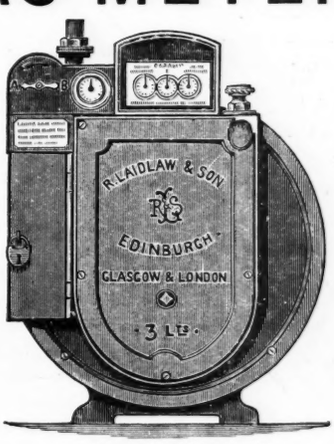


—DRY METER.—



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EDINBURGH: SIMON SQUARE WORKS. | GLASGOW: ALLIANCE FOUNDRY. | LONDON: 6, LITTLE BUSH LANE.

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GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station, or for Export, all kinds of Fuel for Gas and Other Purposes.

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GAS-RETORTS,

Fire-Bricks, Fire-Clay, Lumps, and Tiles

OF EVERY DESCRIPTION.

ESTABLISHED 1836.

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IMPORTANT TO GAS COMPANIES & CORPORATIONS.

The Latest Novelty

THE "BONBEC"

CHIMNEYLESS BURNER

ONE SIZE ONLY.

Will take all ordinary **Rods, Mantles,** and **Globes.** Being fitted with the **Perfect Regulator,** it automatically adapts itself to **all Pressures and Qualities of Gas,** and acts also as a Bye-Pass.

ECONOMICAL. BRILLIANT.

TRADE PRICE 2/6 EACH.

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Importers of Incandescent Gas Accessories and Glass Ware.

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MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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A SPECIALITY—Incandescent Mantles, Brilliant White Light, Durable, at 36s. per gross. Cash with Order.

SPECIAL QUOTATIONS FOR LARGE QUANTITIES. SAMPLE DOZ. 3s. 3d., post free.

Do **NOT** be intimidated by our Rivals, and take no notice of their threats; if you are attacked, communicate with us.

Order early, and your order will be executed in time.

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Buy your **INCANDESCENT BURNERS AND FITTINGS** straight from the Manufacturers. No matter what your requirements, write us, and we will forward, per return, our new Illustrated Price List containing quotations which must interest you. Below we give a few prices, for purposes of comparison with those of other houses. **Incandescent Burners,** Welsbach Pattern, from 4/6 per doz. **Special Offer:** Five gross lots, packing free, £12—*i.e.* 4/- doz. **Unbreakable Mica Chimneys** from 2/6 doz. **Best Magnesia Forks,** latest improvements, 10/- per 1000. **Special Offer,** case containing 5000, 40/-, packing free. **Combination Globes,** 6/6 per doz. **Best Fireproof Chimneys,** specially annealed like Jena, 1/2 per doz. **Special Offer,** case of 50 doz. £2/10, packing free. **Mantleless Burners,** 9/- per doz.

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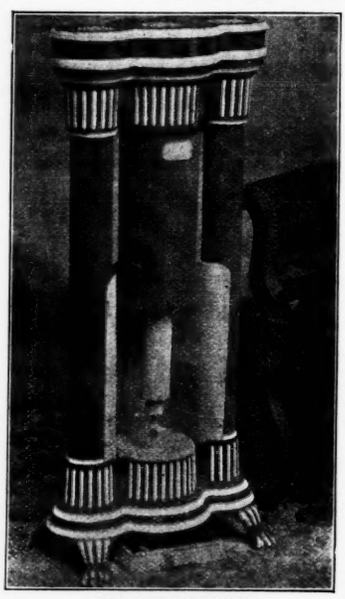
THE "LUX-CALOR" TRADE MARK.

RITCHIE'S PATENT.



D3 LUX-CALOR.

This Stove is let on Hire by the leading Gas Companies.

Full Particulars and Prices from

RITCHIE & CO.,

Contractors for Automatic Supplies to the Gaslight and Coke Company and the South Metropolitan Gas Company,

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LONDON. TELEPHONE 1533 HOP.

INCANDESCENT GAS LIGHTING.

Season 1901-1902.

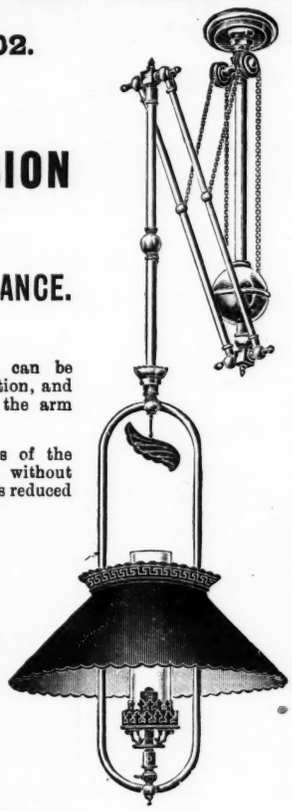
NEW PATENT

GAS SUSPENSION

WITH

PARALLEL MOTION AND BALANCE.

(COWAN'S PATENT.)



These Patent Gas Suspensions can be readily adjusted to any desired position, and can be turned to the right or left, the arm having a radius of 17 inches.

They possess all the advantages of the well-known water-slide principle, without the aid of a water-seal. Vibration is reduced to a minimum.

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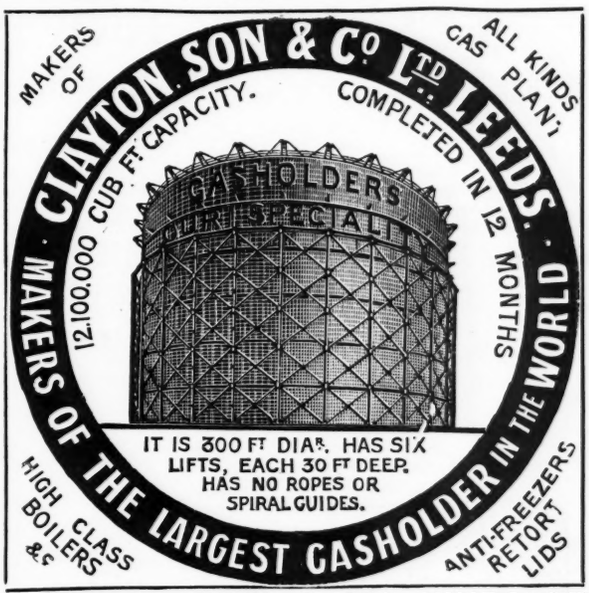
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ALL KINDS GAS PLANT
12,100,000 CUB FT CAPACITY.
COMPLETED IN 12 MONTHS
GASHOLDERS
SPECIALITY
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
IT IS 300 FT DIAR. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
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ANTI-FREEZERS RETORT LIDS

GIRDERS, ROOFS, & ALL KINDS OF STRUCTURAL IRONWORK.

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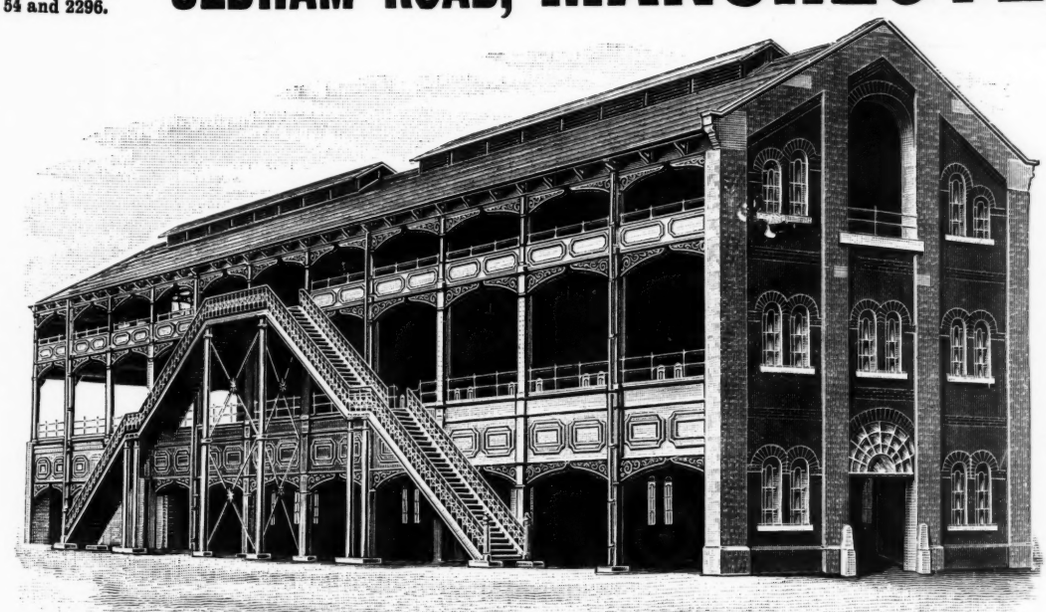


Purifier-Shed, with Ground and Overhead Lime and Oxide Floors, and containing Two Purifiers 72 ft. long by 36 ft. wide, and One Purifier 36 ft. square, on Green's System, without water lutes, erected by us for the Hartlepool Gas and Water Company to designs, and under the Superintendence, of THOS. BOWER, Esq., M.Inst.C.E.

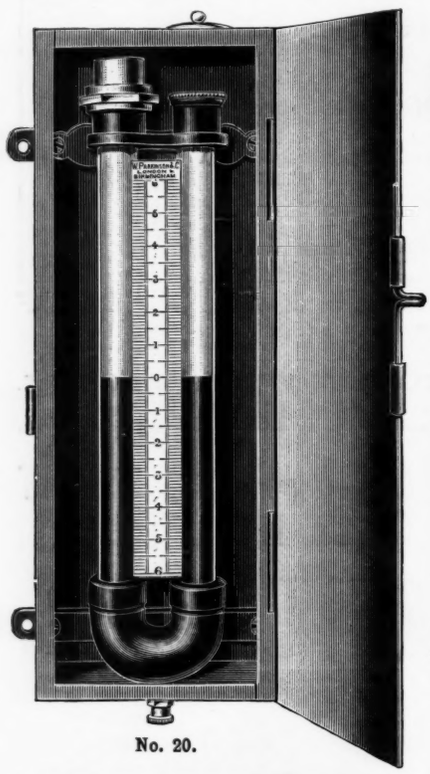
London Office: 165, Gresham House, Old Broad St., E.C.

PARKINSON AND W. & B. COWAN, LTD.

(PARKINSON BRANCH.)

PRESSURE AND VACUUM GAUGES.

The following engravings show a variety of Gauges adapted for different positions on a Gas-Works. The mountings are either of white metal, brass, or gun metal. We pay the greatest attention both to the finish of the mountings and to the selection of the glass tubes used, while every gauge is thoroughly tested for soundness before leaving our works.



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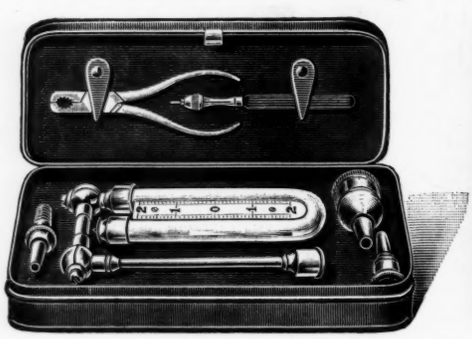


Fig. 2.

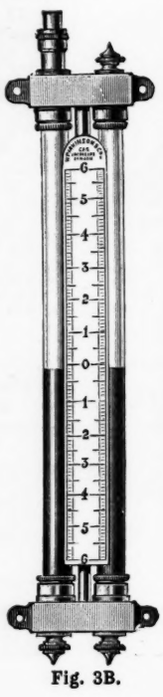


Fig. 3B.

Fig. 1.

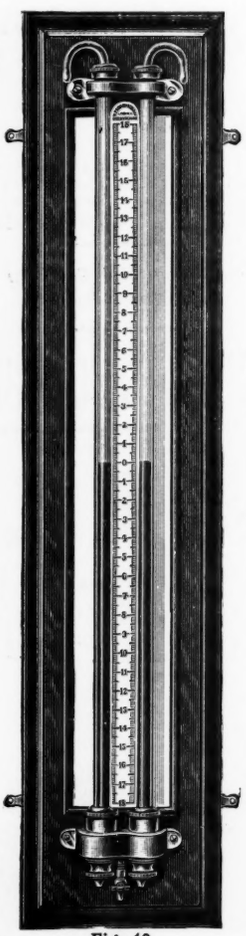
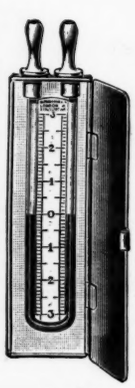
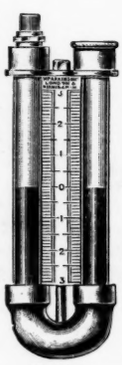


Fig. 10.



No. 30.

Fig. 6.



No. 28.

Fig. 9.

COTTAGE LANE WORKS, CITY ROAD.

LONDON.

Telegrams: "INDEX." Telephone No. 778 King's Cross.

BELL BARN ROAD WORKS,

BIRMINGHAM.

Telegrams: 'GASMETERS." Telephone No. 1101.

[See also Advt. p. 1508.

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